FINAL

BASELINE HUMAN HEALTH RISK ASSESSMENT FOR THE GILT EDGE MINE SITE LAWRENCE COUNTY, SOUTH DAKOTA

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LIST OF ACRONYMS AND ABBREVIATIONS

AFs	Absolute gastrointestinal absorption fraction for lead in soil
ARD	Acid Rock Drainage
AT	Averaging Time
ATV	All Terrain Vehicle
ATSDR	Agency for Toxic Substances and Disease Registry
BHHRA	Baseline Human Heath Risk Assessment
BKSF	Biokinetic Slope Factor
BOR	Bureau of Reclamation
BW	Body Weight
COPC	Chemical of Potential Concern
CTE	Central Tendency Exposure
DI	Daily Intake
DIL	Daily Intake Lifetime
ED	Exposure Duration
EF	Exposure Frequency
EPC	Exposure Point Concentration
FDA	Food and Drug Administration
GM	Geometric Mean
GSD	Geometric Standard Deviation
HDPE	High Density Polyethylene
HEAST	Heath Effects Assessment Summary Tables
HI	Hazard Index
HIF	Human Intake Factor
HQ	Hazard Quotient
IRIS	Integrated Risk Information System
LOAEL	Lowest-observed-adverse-effect-level
MRLs	Minimum Risk Levels
NOAEL	No-observed-adverse-effect-level
NPL	National Priorities List
PbB	Geometric Mean Blood Lead Concentration
PbS	Soil Lead concentration
PF	Park Forest
PPRTVs	Provisional Peer Reviewed Toxicity Values for Superfund
RAGS	Risk Assessment Guidance for Superfund
RBA	Relative Bioavailability
RfD	Reference Dose
SF	Slope Factor
STSC	Superfund Health Risk Technical Support Center
USEPA	United States Environmental Protection Agency
WOE	Weight of Evidence

EXECUTIVE SUMMARY

1.0 INTRODUCTION

This document is a baseline human heath risk assessment (BHHRA) for the Gilt Edge Mine Superfund site in Lawrence County, South Dakota. The purpose of this document is to assess the potential risks to humans, both now and in the future, from site-related contaminants present in environmental media, assuming that no steps are taken to remediate the environment or to reduce human contact with contaminated environmental media. The results of this assessment are intended to help inform risk managers and the public about potential human risks attributable to site-related contaminants and to help determine if there is a need for action at the site.

2.0 SITE CHARACTERIZATION

The Gilt Edge Mine Superfund Site is located in the mining district in the Black Hills of South Dakota, approximately 4.5 miles south-southeast from the town of Lead and immediately adjacent to the upper reaches of Strawberry Creek. The Site is an abandoned 258-acre open pit gold mine, developed in highly sulfidic rock.

3.0 EXPOSURE ASSESSMENT

Site Conceptual Model

The human populations most likely to be exposed at the site include hypothetical future residents, commercial workers, construction workers, current or future recreational visitors.

Figure ES-1 presents a site conceptual model showing the exposure pathways by which site-related chemicals may migrate from on-site sources into other environmental media, and the scenarios by which on-site workers or visitors or off-site residents might reasonably be exposed to site-related contaminants in the environment. However, not all of these potential exposure routes are likely to be of equal concern. Exposure scenarios that are considered to be complete and potentially significant are shown by boxes containing a solid black circle. Pathways that are judged to be complete but which are likely to contribute only occasional or minor exposures are shown by boxes with an "X". Incomplete pathways (i.e., those which are not thought to occur) are shown by open boxes.

Chemicals of Potential Concern

Chemicals of Potential Concern (COPCs) are chemicals which exist in the environment at concentration levels that might be of potential health concern to humans and which are or might be derived, at least in part, from site-related sources. COPCs were selected at the site using a conservative screening procedure that is intended to ensure that any chemical of plausible human health concern is retained for evaluation. Table ES-1 lists the COPCs identified for quantitative evaluation at this site.

Evaluation of Exposure

Risk from a chemical contaminant is related to the level of exposure or contact with the chemical. For every exposure pathway of potential concern, it is expected that there will be differences between different individuals in the level of exposure at a specific location due to differences in intake rates, body weights, exposure frequencies and exposure durations. Thus, there is normally a wide range of average daily intakes between different members of an exposed population. Because of this, all daily intake calculations must specify what part of the range of doses is being estimated. Typically, attention is focused on intakes that are "average" or are otherwise near the central portion of the range, and on intakes that are near the upper end of the range (e.g., the 95th percentile). These two exposure estimates are referred to as Central Tendency Exposure (CTE) and Reasonable Maximum Exposure (RME), respectively.

All estimates of CTE and RME exposure were calculated in accord with current USEPA guidance for quantification of exposure. Exposure parameters were based on reliable site-specific data where possible, and national default values or professional judgement whenever reliable site data were not available.

Exposure Points

An exposure point (also referred to as an exposure unit or exposure area) is an area where a receptor (worker, visitor, or resident) may be exposed to one or more environmental media. Selection of the bounds of an exposure point or exposure unit is based mainly on a consideration of the likely activity patterns of the exposed receptors; that is, an exposure point is an area within which a receptor is likely to spend most of their time and to move about more or less at random. The exposure units for the site are presented in Figures ES-2 through ES-6 and are summarized in Tables ES-2 and ES-3.

For soil, the mine site was divided up into 5 soil exposure units, based on current site features (see Figure ES-2 and Table ES-2). For groundwater, because concentration of chemicals in groundwater may vary depending on the precise location of a well, individual wells were selected as groundwater exposure units (see Figure ES-3 and Tables ES-2 and ES-3). Because the concentrations of metals in surface water and sediment may vary between surface water bodies and can be influenced by confluences with other tributaries, exposure units for surface water, sediment and fish tissue were defined as a surface water body (i.e., pit lake, pond) or stream reach (see Figures ES-4 through ES-6 and Tables ES-2 and ES-3).

Calculation of Exposure Point Concentrations (EPCs)

Because of the assumption of random exposure over an exposure area, risk from a chemical is related to the arithmetic mean concentration of that chemical averaged over the entire exposure area. Since the true arithmetic mean concentration cannot be calculated with certainty from a limited number of measurements, the USEPA recommends that the upper 95th percentile confidence limit (UCL) of the arithmetic mean at each exposure point be used when calculating exposure and risk at that location. If the 95% UCL exceeds the highest detected concentration, the highest detected value is used instead.

4.0 TOXICITY ASSESSMENT

A toxicity assessment for a chemical identifies what adverse health effects the chemical causes, and how the appearance of these adverse effects depends on exposure level. The toxicity assessment process is usually divided into two parts: the first characterizes and quantifies the non-cancer effects of the chemical, while the second addresses the cancer effects of the chemical.

Non-Cancer Effects

Essentially all chemicals can cause adverse health effects if given at a high enough dose. However, when the dose is sufficiently low, typically no adverse effect is observed. Thus, in characterizing the non-cancer effects of a chemical, the key parameter is the dose at which an adverse effect first becomes evident. Doses below this "threshold" are considered to be safe, while doses above the threshold are likely to cause an effect. Based on a thorough review of all available data, EPA identifies an Reference Dose (RfD) to be used as a conservative estimate of the threshold. The RfD is an estimate (with uncertainty spanning perhaps an order of magnitude) of a daily exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious effects during a lifetime.

Cancer Effects

For cancer effects, the toxicity assessment process has two components. The first is a qualitative evaluation of the weight of evidence (WOE) that the chemical does or does not cause cancer in humans. For chemicals which are considered known or possible human carcinogens, the second part of the toxicity assessment is to describe the carcinogenic potency of the chemical. This is done by quantifying how the number of cancers observed in exposed animals or humans increases as the dose increases. Typically, it is assumed that the dose response curve for cancer has no threshold, arising from the origin and increasing linearly until high doses are reached. Thus, the most convenient descriptor of cancer potency is the slope of the dose-response curve at low doses (where the slope is still linear). This is referred to as the Slope Factor (SF), which has dimensions of risk of cancer per unit dose.

Toxicity Values

All toxicity values (RfD and SF values) used in this risk assessment were derived by USEPA, and were obtained either from on-line database referred to as "IRIS" (Integrated

Risk Information System), from USEPA's Health Effects Assessment Summary Tables (HEAST), or from interim recommendations from USEPA's Superfund Technical Assistance Center operated by the National Center for Environmental Assessment (NCEA).

Adjustment for Relative Bioavailability

Accurate assessment of human exposure to ingested metals requires knowledge of the amount of metal absorbed from the gastrointestinal tract into the body. This information is especially important for environmental media such as soil or mine wastes, because metals in these media may exist, at least in part, in a variety of poorly water soluble minerals, and may also exist inside particles of inert matrix such as rock or slag. These chemical and physical properties may tend to influence (usually decrease) the absorption (bioavailability) of the metals when ingested.

In general, the most reliable means for obtaining absorption data on a metal that is present in a particular soil or mine waste is to study the rate and extent of absorption of the metal when the material is fed to an appropriate test animal. However, such *in vivo* studies are slow and costly, and no such *in vivo* test results exist for soils from this site.

In vivo testing of arsenic in soil and mine waste has been conducted at a variety of other sites in the Rocky Mountain West (USEPA 2005b). Based on an analysis of RBA in 26 test materials, an RBA of 0.5 was selected for use in this risk assessment and is considered a generally conservative default value for arsenic in soil. In the absence of site-specific data, the RBA for all chemicals in all media was assumed to be 1.0 (USEPA 1989), with the exception of lead where the USEPA (1994b and 2003c) recommended default RBA for lead in soil of 0.6 was assumed.

5.0 RISK CHARACTERIZATION

Basic Approach for Characterizing Non-Cancer Risks

For most chemicals, the potential for non-cancer effects is evaluated by comparing the estimated daily intake of the chemical over a specific time period with the RfD for that chemical derived for a similar exposed period. This comparison results in a non-cancer Hazard Quotient (HQ), as follows:

$$HQ = DI / RfD$$

where:

HQ	=	Hazard Quotient
DI	=	Daily Intake (mg/kg-day)
RfD	=	Reference Dose (mg/kg-day)

If the HQ for a chemical is equal to or less than one, it is believed that there is no appreciable risk that non-cancer health effects will occur. If an HQ exceeds one, there is some possibility that non-cancer effects may occur, although an HQ above one does not indicate an effect will definitely occur. This is because of the margin of safety inherent in the derivation of all RfD values. However, the larger the HQ value, the more likely it is that an adverse effect may occur.

If an individual is exposed to more than one chemical, a screening-level estimate of the total non-cancer risk is derived simply by summing the HQ values for that individual. This total is referred to as the Hazard Index (HI). If the HI value is less than one, non-cancer risks are not expected from any chemical, alone or in combination with others. If the screening level HI exceeds one, it may be appropriate to perform a follow-on evaluation in which HQ values are added only if they affect the same target tissue or organ system (e.g., the liver). This is because chemicals which do not cause toxicity in the same tissues are not likely to cause additive effects.

In the case of lead, risks are evaluated using a somewhat different approach. In brief, mathematical models are used to estimate the distribution of blood lead values in a population of people exposed to lead under a specified set of conditions. Health risks are judged to be acceptable if there is no more than a 5% chance that an exposed individual (a child or a woman of child-bearing age) will have a blood lead level that exceeds 10 ug/dL. For convenience, this probability is referred to as P10.

Basic Approach for Characterizing Cancer Risks

The excess risk of cancer from exposure to a chemical is described in terms of the probability that an exposed individual will develop cancer because of that exposure by age 70. For each chemical of concern, this value is calculated from the daily intake of the chemical from the site, averaged over a lifetime (DIL), and the slope factor (SF) for the chemical, as follows (USEPA 1989):

$$\text{Excess Cancer Risk} = 1 - \exp(-DI_L \cdot SF)$$

Excess cancer risks are summed across all chemicals of concern and all exposure pathways that contribute to exposure of an individual in a given population.

The level of total cancer risk that is of concern is a matter of personal, community, and regulatory judgement. In general, the USEPA considers excess cancer risks that are below about 1 in 1,000,000 to be so small as to be negligible, and risks above 1 in 10,000 to be sufficiently large that some sort of remediation is desirable. Excess cancer risks that range between 1 in 10,000 and 1 in 1,000,000 are generally considered to be acceptable, although this is evaluated on a case by case basis.

Risk Estimates for On-Site ATV Riders

Table ES-4 summarizes the total risks to ATV riders from the ingestion and inhalation of surface soil. As seen, the total risks are below a level of concern to CTE individuals in all exposure areas, but may be above a level of concern to an RME individual for non-cancer effects in all exposure areas and cancer effects in one exposure area (LP). Non-cancer risks at all locations are primarily due to the inhalation of manganese. Ingestion of thallium also contributes to the non-cancer risks at two areas (AH&P and LP). Cancer risks are due to ingestion of arsenic, with additional contributions from the inhalation pathway. Risks from lead are below a level of concern at all locations. These results indicate that levels of thallium, arsenic and manganese in on-site soils may pose a risk to ATV riders who visit the site for recreation.

Risk Estimates for On-Site Hikers

Table ES-5 presents the total risks to hikers from the incidental ingestion of on-site surface soil, sediment and surface water during recreational activities. Total non-cancer and cancer risks to a CTE individual are below a level of concern at all locations, but exceed a level of concern to a RME individual at several locations. Non-cancer risks are driven by the incidental ingestion of metals in surface water with additional contributions from the ingestion of surface soil, with the exception of the AH&P area of the site and at 3 surface water/sediment exposure units (LA, LCPD and PDC) within the PCA area of the site. For exposures that occur in the AH&P area of the site, non-cancer risks are driven by the incidental ingestion of thallium in surface soil. Non-cancer risks in the southwestern area of the PCA exposure unit (at surface water/sediment exposure units LA, LCPD and PDC) are driven by both thallium and arsenic in surface soil. Cancer risks exceeding a 1E-04 level of concern are driven by arsenic in surface water with additional contributions from arsenic in sediment at some locations. Risks to hikers from lead are not of concern at any location. These results indicate that risks from exposure to surface water, sediment and surface soil at the site are likely to be below a level of concern for most recreational visitors, but could be of potential concern to individuals with RME exposures if exposure were to occur repeatedly in some locations.

Risk Estimates for On-Site Residents

Table ES-6 summarizes the total risks to hypothetical future on-site residents from the incidental ingestion of soil and groundwater. As seen, non-cancer risks are above a level of concern at all locations. Non-cancer risks at most locations are driven by ingestion groundwater at the site with additional contributions from soil ingestion. At two locations (well BED-8 and GE-MW-06), non-cancer risks are driven by the ingestion of thallium in surface soil with additional contributions from groundwater ingestion. Non-cancer risks from groundwater ingestion are driven by several metals (arsenic, cadmium, chromium, copper, iron, antimony, zinc, manganese, aluminum, and thallium) in both the dissolved and total fractions, whereas non-cancer risks from soil ingestion are driven by arsenic and thallium. Total cancer risks exceed a 1E-04 at all locations for a resident with RME exposure, and at several locations for a resident with CTE exposure. All cancer risks are due to the ingestion of arsenic in both surface soil and groundwater. The exposure pathway contributing the maximum cancer risk varies from location to location. Risks from lead would be of concern to residents at some locations due to the concentration of dissolved and total lead in groundwater. These results indicate that concentrations of arsenic, lead and other metals in soil and groundwater would be of concern to hypothetical future residents.

Risk Estimates for On-Site Commercial Workers

Table ES-7 summarizes the total risks to hypothetical future on-site commercial workers. Non-cancer risks to a worker with both CTE and RME exposures exceed a level of concern at all locations, with one exception (well GW-10A). These risks are almost entirely due to the ingestion of groundwater, with additional contributions from soil at some locations. The chemicals driving the non-cancer risks from groundwater ingestion vary from location to location and include arsenic, cadmium, chromium, copper, iron, antimony, zinc, manganese, aluminum, and thallium in both the dissolved and total fractions. The non-cancer risk driver for the soil ingestion exposure pathway is thallium. Total cancer risks exceed a 1E-04 level of concern at most locations for workers with RME exposure to site media and at a few locations for an individual with CTE exposure. These risks are driven by the groundwater ingestion pathway due to concentrations of dissolved and total arsenic. Risks from lead exceed EPA's health based goal (P10<5%) for a pregnant worker at 3 locations (wells CDM03b, CDM04b and GE-MW-08) due to ingestion of dissolved or total lead in groundwater. These results indicate that concentrations of arsenic and lead and other metals in groundwater and the concentration of thallium in surface soil would be of concern to commercial workers under a future land use scenario.

Risk Estimates for On-Site Construction Workers

Table ES-8 summarizes the total risks to hypothetical future construction workers from ingestion and inhalation of surface and sub-surface soil at the site. Non-cancer risks are above a level of concern at all locations, while cancer risks not of concern at any location. The non-cancer risks are due almost entirely to ingestion exposure, and risks from inhalation exposure are minimal. Non-cancer risks are primarily due to thallium with additional contributions from arsenic at two areas (HLP and LP). Risks from lead are below a level of concern at all locations. These results indicate that levels of thallium and arsenic in soil may pose a risk to on-site construction workers during future excavation or maintenance work at the site.

Risk Estimates for Off-Site Children

Table ES-9 presents the total risks to children playing in off-site drainages from surface water and sediment. Total non-cancer and total cancer risks are below a level of concern at all locations. Risks from lead are also below a level of concern at all locations. These results indicate that there is little risk to children or other recreational visitors who may have contact with surface water or sediment along off-site creeks and drainages.

Risk Estimates for Off-Site Recreational Fishermen

Table ES-10 summarizes the total risks to recreational fisherman from the ingestion of sediment, surface water and fish in off-site drainages. As seen, non-cancer and cancer risks from surface water and sediment that are below a level of concern at all locations. At this location, the total cancer risks exceed a level of concern for an RME individual from the ingestion of arsenic in surface water. Risks from lead are below a level of concern at all locations. These results indicate that there is little risk to recreational fisherman from ingestion of fish or who may have contact with surface water or sediment along off-site creeks.

Risk Estimates for Off-Site Residents

Table ES-11 summarizes risks to current or hypothetical future residents from ingestion of groundwater from off-site wells located mainly along creeks and channels that drain from the site. Results are presented both for dissolved metals (Panel A) and for total metals (Panel B). As seen, non-cancer risks are above a level of concern for many well locations, both for a CTE and RME receptor, for both dissolved and total metals. This risk is attributable to numerous chemicals, including arsenic, cadmium copper, iron, manganese, antimony, and thallium, with the relative contribution varying from well to well. Cancer risks for both dissolved and total metals exceed 1E-04 for RME receptors at a number of wells, with all values exceeding 1E-05. This risk is due to arsenic in the groundwater. Lead risks are not above a level of concern based on dissolved or total metals, with the exception of one well (BED-19). The concentration of lead in the total fraction at this location exceeds EPA's health based goal (P10 < 5%). This suggests that the water contains suspended particulate matter, which would be of potential concern if not filtered or allowed to settle before ingestion. These results indicate that ingestion of groundwater from wells on the site is likely to pose unacceptable levels of non-cancer and cancer risk in most locations, due to the presence of numerous dissolved and suspended metals.

6.0 UNCERTAINTIES

Quantitative evaluation of the risks to humans from environmental contamination is frequently limited by uncertainty regarding a number of key data items, including concentration levels in the environment, the true level of human contact with contaminated media, and the true dose-response curves for non-cancer and cancer effects in humans. This uncertainty is usually addressed by making assumptions or estimates for uncertain parameters based on whatever limited data are available. Because of these assumptions and estimates, the results of risk calculations are themselves uncertain, and it is important for risk managers and the public to keep this in mind when interpreting the results of a risk assessment. In most cases, assumptions employed in this risk assessment to deal with uncertainties were intentionally conservative; that is, they are more likely to lead to an overestimate rather than an underestimate of risk

Table ES-1. Quantitative Chemicals of Potential Concern for the Human Health Risk Assessment

CHEMICAL	SOIL	SEDIMENT	SURFACE WATER	GROUNDWATER	FISH TISSUE
Aluminum	X	X	X	X	X
Antimony	X	X		X	
Arsenic	X	X	X	X	X
Barium					
Beryllium		X	X	X	
Bismuth					
Boron					
Cadmium	X	X	X	X	X
Calcium					
Chromium	X	X	X	X	X
Cobalt		X	X	X	X
Copper	X	X	X	X	
Cyanide			X		
Gold					
Iron	X	X	X	X	X
Lead	X	X	X	X	
Lithium			X		
Magnesium					
Manganese	X	X	X	X	X
Mercury				X	X
Molybdenum	X				
Nickel	X	X	X	X	X
Nitrate			X	X	
Nitrite				X	
Phosphorus					
Potassium					
Scandium					
Selenium			X	X	X
Silver			X	X	
Sodium					
Strontium			X		
Thallium	X	X	X	X	
Tin					
Titanium					
Tungsten					
Vanadium	X	X	X	X	
Ytrium					
Zinc	X	X	X	X	X
Zirconium					

Table ES-2. On-Site Exposure Units

Media	Exposure Unit ID	Exposure Unit Description	Corresponding Soil Exposure Unit
Surface Soil	AH&P	Anchor Hill and Ponds	--
	HLP	Heap Leach Pad	--
	LP	Langley Pit	--
	PCA	Pits and Crusher Area	--
	RGWRD	Ruby Gulch Waste Rock Repository	--
Surface and Subsurface Soil (combined)	AH&P	Anchor Hill and Ponds	--
	HLP	Heap Leach Pad	--
	LP	Langley Pit	--
	PCA	Pits and Crusher Area	--
	RGWRD	Ruby Gulch Waste Rock Repository	--
Groundwater	BED-8	Well BED-8	AH&P
	CDM01b	Well CDM01b	PCA
	CDM02	Well CDM02	PCA
	CDM03b	Well CDM03b	PCA
	CDM04b	Well CDM04b	PCA
	GE-MW-06	Well GE-MW-06	LP
	GE-MW-07	Well GE-MW-07	PCA
	GE-MW-08	Well GE-MW-08	AH&P
	GE-MW-15	Well GE-MW-15	PCA
	GE-MW-16	Well GE-MW-16	PCA
	GE-MW-17	Well GE-MW-17	PCA
	GW-10A	Well GW-10A	RGWRD
	GW-8	Well GW-8	RGWRD
	GWCDM11	Well GWCDM11	PCA
	GWCDM12	Well GWCDM12	PCA
Surface Water	AHPL	Anchor Hill Pit Lake	AH&P
	BKD2	Background2	AH&P
	DMPL	Dakota Maid Pit Lake	PCA
	HLP	Heap Leach Pad	HLP
	LA	Langley Adit	PCA
	LCPD	Last Chance Pond	PCA
	PDC	Pond C	PCA
	PDD	Pond-D	PCA
	PDE	Pond E	PCA
	RGT	Ruby Gulch Tributary	RGWRD
	RPD	Ruby Pond	RGWRD
	RRB	Base of Ruby Repository	RGWRD
	SC1	Strawberry Creek above Confluence with Cabin Creek	PCA
	SCHW	Strawberry Creek Headwaters	AH&P
	SGPD	Surge Pond	AH&P
	SPL	Sunday Pit Lake	PCA
	SWPD	Stormwater Pond	AH&P
Sediment	AHPL	Anchor Hill Pit Lake	AH&P
	BKD2	Background2	AH&P
	BKD3	Background3	AH&P
	DMPL	Dakota Maid Pit Lake	PCA
	HLP	Heap Leach Pad	HLP
	LA	Langley Adit	PCA
	PDC	Pond C	PCA
	PDD	Pond-D	PCA
	RGT	Ruby Gulch Tributary	RGWRD
	SC1	Strawberry Creek above Confluence with Cabin Creek	PCA
	SCHW	Strawberry Creek Headwaters	AH&P
	SPL	Sunday Pit Lake	PCA

Table ES-3. Off-Site Exposure Units

Media	Exposure Unit ID	Exposure Unit Description
Groundwater	BED11	Well BED11
	BED-14	Well BED-14
	BED-19	Well BED-19
	BED-7	Well BED-7
	BES-11	Well BES-11
	BES-14	Well BES-14
	BES-17	Well BES-17
	CDM06b	Well CDM06b
	GE-MW-18	Well GE-MW-18
	GE-MW-19	Well GE-MW-19
	GW-6	Well GW-6
	GW-7	Well GW-7
	GW-8A	Well GW-8A
	GW-9A	Well GW-9A
	GWCDM09	Well GWCDM09
	GWCDM10	Well GWCDM10
	GWCDM14	Well GWCDM14
Surface Water	BBC0	Bear Butte Creek upstream of confluence with Strawberry Creek
	BBC1	Bear Butte Creek btwn Strawbeery Creek and Terrible Gulch
	BBC2	Bear Butte Creek btwn Terrible Gulch and Ruby Gulch
	BBC3	Bear Butte Creek btwn Ruby Gulch and Butcher Gulch
	BBC4	Bear Butte Creek downstream of Butcher Gulch
	BHG	Butcher Gulch
	BKD1	Background1
	BMG	Boomer Gulch
	CC	Cabin Creek
	HG	Hoodo Gulch
	OFA	Oro Fino Adit
	RG	Ruby Gulch
	SC2	Strawberry Creek btwn Cabin Creek and Hoodo Gulch
	SC3	Strawbeery Creek btwn Hoodo Gulch and Boomer Gulch
	SC4	Strawberry Creek btwn Boomer Gulch and Bear Butte Creek
	TG	Terrible Gulch
Sediment	BEC0	Bear Butte Creek upstream of confluence with Strawberry Creek
	BEC1	Bear Butte Creek btwn Strawbeery Creek and Terrible Gulch
	BEC2	Bear Butte Creek btwn Terrible Gulch and Ruby Gulch
	BEC3	Bear Butte Creek btwn Ruby Gulch and Butcher Gulch
	BEC4	Bear Butte Creek downstream of Butcher Gulch
	BHG	Butcher Gulch
	BKD1	Background1
	BMG	Boomer Gulch
	CC	Cabin Creek
	HG	Hoodo Gulch
	OFA	Oro Fino Adit
	RG	Ruby Gulch
	SC2	Strawberry Creek btwn Cabin Creek and Hoodo Gulch
	SC3	Strawbeery Creek btwn Hoodo Gulch and Boomer Gulch
	SC4	Strawberry Creek btwn Boomer Gulch and Bear Butte Creek
	TG	Terrible Gulch
Fish Tissue	BEC0	Bear Butte Creek upstream of confluence with Strawberry Creek
	BEC1	Bear Butte Creek btwn Strawbeery Creek and Terrible Gulch
	BEC2	Bear Butte Creek btwn Terrible Gulch and Ruby Gulch
	BEC3	Bear Butte Creek btwn Ruby Gulch and Butcher Gulch
	BEC4	Bear Butte Creek downstream of Butcher Gulch
	BMG	Boomer Gulch
	SC2	Strawberry Creek btwn Cabin Creek and Hoodo Gulch
	SC4	Strawberry Creek btwn Boomer Gulch and Bear Butte Creek

Table ES-4.
Risks to Recreational Visitors (ATV Riders) from Incidental Ingestion and Inhalation of On-Site Soils

Exposure Unit	HI		Cancer Risk		$P10_{fetus}$ % (lead risk)
	CTE	RME	CTE	RME	
AH&P	1E+00	1E+01	2E-06	5E-05	<0.1
HLP	3E-01	3E+00	4E-06	1E-04	<0.1
LP	8E-01	8E+00	6E-06	2E-04	<0.1
PCA	3E-01	3E+00	2E-06	5E-05	<0.1
RGWRD	3E-01	2E+00	8E-07	3E-05	<0.1

Shaded cells indicate locations where noncancer risks exceed an HI of 1E+00 , a cancer risk of 1E-04, or a P10 value of 5%.

Table ES-5
Total Risks to Hikers from On-Site Surface Water, Sediment, and Soil

Exposure Units		Non-Cancer HI								Cancer Risk								P10$_{child}$ (%) (lead)
Surface Water & Sediment	Soil	Surface Water		Sediment		Soil		Total		Surface Water		Sediment		Soil		Total		
		CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	
AHPL	AH&P	8E-03	7E-01	6E-02	6E-01	4E-01	4E+00	5E-01	4E+00	9E-09	3E-06	4E-07	1E-05	1E-06	4E-05	2E-06	4E-05	<0.1
BKD2	AH&P	2E-04	2E-02	5E-03	5E-02	4E-01	4E+00	4E-01	4E+00	2E-09	6E-07	1E-07	3E-06	1E-06	4E-05	1E-06	4E-05	<0.1
BKD3	AH&P	--	--	1E-02	1E-01	4E-01	4E+00	4E-01	4E+00	--	--	3E-07	9E-06	1E-06	4E-05	1E-06	4E-05	<0.1
DMPL	PCA	7E-02	6E+00	1E-01	1E+00	2E-01	2E+00	4E-01	7E+00	2E-06	6E-04	6E-06	2E-04	9E-07	3E-05	9E-06	6E-04	<0.1
HLP	HLP	1E-02	1E+00	2E-02	2E-01	2E-01	1E+00	2E-01	2E+00	3E-07	1E-04	3E-07	9E-06	3E-06	1E-04	4E-06	1E-04	<0.1
LA	PCA	1E-04	1E-03	5E-02	5E-01	2E-01	2E+00	2E-01	2E+00	4E-09	1E-07	3E-06	8E-05	9E-07	3E-05	4E-06	9E-05	<0.1
LCPD	PCA	7E-03	6E-01	--	--	2E-01	2E+00	2E-01	2E+00	1E-08	4E-06	--	--	9E-07	3E-05	1E-06	3E-05	<0.1
PDC	PCA	1E-03	1E-01	1E-02	1E-01	2E-01	2E+00	2E-01	2E+00	2E-09	6E-07	3E-07	1E-05	9E-07	3E-05	1E-06	3E-05	<0.1
PDD	PCA	4E-02	3E+00	8E-02	7E-01	2E-01	2E+00	3E-01	4E+00	6E-07	2E-04	4E-06	1E-04	9E-07	3E-05	5E-06	2E-04	<0.1
PDE	PCA	4E-02	4E+00	--	--	2E-01	2E+00	2E-01	4E+00	5E-07	1E-04	--	--	9E-07	3E-05	1E-06	2E-04	<0.1
RGT	RGWRD	1E-04	1E-02	1E-02	1E-01	2E-02	2E-01	3E-02	2E-01	1E-09	4E-07	5E-07	1E-05	6E-07	2E-05	1E-06	2E-05	<0.1
RPD	RGWRD	8E-02	7E+00	--	--	2E-02	2E-01	1E-01	7E+00	2E-06	6E-04	--	--	6E-07	2E-05	3E-06	6E-04	<0.1
RRB	RGWRD	1E-01	9E+00	--	--	2E-02	2E-01	1E-01	9E+00	3E-06	9E-04	--	--	6E-07	2E-05	4E-06	1E-03	<0.1
SC1	PCA	3E-02	2E+00	4E-02	4E-01	2E-01	2E+00	2E-01	3E+00	7E-07	2E-04	1E-06	3E-05	9E-07	3E-05	3E-06	2E-04	<0.1
SCHW	AH&P	2E-04	2E-02	7E-03	6E-02	4E-01	4E+00	4E-01	4E+00	1E-09	4E-07	1E-07	4E-06	1E-06	4E-05	1E-06	4E-05	<0.1
SGPD	AH&P	7E-03	6E-01	--	--	4E-01	4E+00	4E-01	4E+00	2E-08	5E-06	--	--	1E-06	4E-05	1E-06	4E-05	<0.1
SPL	PCA	4E-02	3E+00	1E-01	1E+00	2E-01	2E+00	3E-01	4E+00	8E-07	2E-04	6E-06	2E-04	9E-07	3E-05	8E-06	2E-04	<0.1
SWPD	AH&P	7E-03	6E-01	--	--	4E-01	4E+00	4E-01	4E+00	1E-08	4E-06	--	--	1E-06	4E-05	1E-06	4E-05	<0.1
--	LP	--	--	--	--	7E-01	7E+00	7E-01	7E+00	--	--	--	--	4E-06	1E-04	4E-06	1E-04	<0.1

Shaded cells indicate locations where noncancer risks exceed an HI of 1E+00 , a cancer risk of 1E-04, or a P10 value of 5%.

Total Risk = RME (exposure pathway with maximum risk) + (30/9)*CTE (all other exposure pathways)

Table ES-6.
Risks to Hypothetical Future Residents from Ingestion of On-Site Groundwater and Soil

Panel A. Dissolved Metals

Exposure Units		Non Cancer HI						Cancer Risk						P10 (%) (lead)
Groundwater Well	Soil Exposure Unit	Groundwater		Soil		Total		Groundwater		Soil		Total		
		CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	
BED-8	AH&P	6E+00	1E+01	1E+01	3E+01	2E+01	5E+01	2E-05	2E-04	3E-05	3E-04	5E-05	3E-04	<0.1
CDM01b	PCA	6E+00	1E+01	4E+00	1E+01	1E+01	3E+01	2E-05	2E-04	2E-05	2E-04	5E-05	3E-04	<0.1
CDM02	PCA	3E+01	7E+01	4E+00	1E+01	4E+01	8E+01	2E-05	2E-04	2E-05	2E-04	5E-05	3E-04	<0.1
CDM03b	PCA	4E+02	7E+02	4E+00	1E+01	4E+02	8E+02	2E-03	1E-02	2E-05	2E-04	2E-03	1E-02	79
CDM04b	PCA	7E+00	2E+01	4E+00	1E+01	1E+01	3E+01	3E-04	2E-03	2E-05	2E-04	3E-04	2E-03	65
GE-MW-06	LP	2E+01	4E+01	2E+01	5E+01	4E+01	1E+02	1E-04	1E-03	1E-04	1E-03	2E-04	1E-03	65
GE-MW-07	PCA	1E+01	3E+01	4E+00	1E+01	2E+01	4E+01	3E-05	2E-04	2E-05	2E-04	5E-05	3E-04	<0.1
GE-MW-08	AH&P	1E+02	3E+02	1E+01	3E+01	1E+02	3E+02	5E-04	4E-03	3E-05	3E-04	6E-04	4E-03	100
GE-MW-15	PCA	5E+01	1E+02	4E+00	1E+01	6E+01	1E+02	2E-05	1E-04	2E-05	2E-04	4E-05	3E-04	1.29
GE-MW-16	PCA	5E+01	1E+02	4E+00	1E+01	6E+01	1E+02	8E-05	5E-04	2E-05	2E-04	1E-04	6E-04	<0.1
GE-MW-17	PCA	3E+01	7E+01	4E+00	1E+01	4E+01	8E+01	8E-06	6E-05	2E-05	2E-04	3E-05	2E-04	1.4
GW-10A	RGWRD	2E+00	3E+00	5E-01	1E+00	2E+00	5E+00	2E-05	2E-04	2E-05	1E-04	4E-05	2E-04	<0.1
GW-8	RGWRD	3E+01	6E+01	5E-01	1E+00	3E+01	6E+01	5E-05	4E-04	2E-05	1E-04	7E-05	4E-04	<0.1
GWCDM11	PCA	5E+00	1E+01	4E+00	1E+01	9E+00	2E+01	2E-05	2E-04	2E-05	2E-04	5E-05	3E-04	<0.1
GWCDM12	PCA	1E+01	3E+01	4E+00	1E+01	2E+01	4E+01	2E-05	2E-04	2E-05	2E-04	5E-05	3E-04	<0.1
--	HLP	--	--	4E+00	1E+01	4E+00	1E+01	--	--	7E-05	7E-04	7E-05	7E-04	0.50

Panel B. Total Metals

Exposure Units		Non Cancer HI						Cancer Risk						P10 (%) (lead)
Groundwater Well	Soil Exposure Unit	Groundwater		Soil		Total		Groundwater		Soil		Total		
		CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	
BED-8	AH&P	6E+00	1E+01	1E+01	3E+01	2E+01	4E+01	2E-05	2E-04	3E-05	3E-04	5E-05	3E-04	<0.1
CDM01b	PCA	8E+00	2E+01	4E+00	1E+01	1E+01	3E+01	4E-05	3E-04	2E-05	2E-04	6E-05	4E-04	<0.1
CDM02	PCA	3E+01	6E+01	4E+00	1E+01	3E+01	7E+01	3E-05	2E-04	2E-05	2E-04	5E-05	3E-04	<0.1
CDM03b	PCA	4E+02	8E+02	4E+00	1E+01	4E+02	8E+02	3E-03	2E-02	2E-05	2E-04	3E-03	2E-02	89
CDM04b	PCA	3E+01	7E+01	4E+00	1E+01	4E+01	8E+01	1E-03	9E-03	2E-05	2E-04	1E-03	9E-03	100
GE-MW-06	LP	2E+01	4E+01	2E+01	5E+01	4E+01	9E+01	2E-04	1E-03	1E-04	1E-03	3E-04	1E-03	71
GE-MW-07	PCA	1E+01	3E+01	4E+00	1E+01	2E+01	4E+01	3E-05	2E-04	2E-05	2E-04	5E-05	3E-04	<0.1
GE-MW-08	AH&P	1E+02	3E+02	1E+01	3E+01	2E+02	3E+02	6E-04	4E-03	3E-05	3E-04	6E-04	4E-03	100
GE-MW-15	PCA	4E+01	8E+01	4E+00	1E+01	4E+01	9E+01	--	--	2E-05	2E-04	2E-05	2E-04	1
GE-MW-16	PCA	6E+01	1E+02	4E+00	1E+01	6E+01	1E+02	1E-04	8E-04	2E-05	2E-04	1E-04	8E-04	1
GE-MW-17	PCA	3E+01	7E+01	4E+00	1E+01	4E+01	8E+01	8E-06	6E-05	2E-05	2E-04	3E-05	2E-04	2
GW-10A	RGWRD	2E+00	4E+00	5E-01	1E+00	2E+00	5E+00	3E-05	2E-04	2E-05	1E-04	5E-05	3E-04	10
GW-8	RGWRD	3E+01	6E+01	5E-01	1E+00	3E+01	7E+01	1E-04	8E-04	2E-05	1E-04	1E-04	9E-04	<0.1
GWCDM11	PCA	1E+01	3E+01	4E+00	1E+01	2E+01	4E+01	5E-05	4E-04	2E-05	2E-04	7E-05	4E-04	<0.1
GWCDM12	PCA	1E+01	3E+01	4E+00	1E+01	2E+01	4E+01	5E-05	3E-04	2E-05	2E-04	7E-05	4E-04	<0.1
--	HLP	--	--	4E+00	1E+01	4E+00	1E+01	--	--	7E-05	7E-04	7E-05	7E-04	0.50

Shaded cells indicate locations where noncancer risks exceed an HI of 1E+00 or a cancer risk of 1E-04.

Total Risk = RME (exposure pathway with maximum risk) + (30/9)*CTE (all other exposure pathways)

Table ES-7.

Total Risks to Hypothetical Future Commercial Workers from Ingestion of On-Site Groundwater and Surface Soil

Panel A. Dissolved Metals

Exposure Units		Non Cancer HI						Cancer Risk						$P10_{fetus}$ (%) (lead)
Groundwater Well	Soil Exposure Unit	Groundwater		Soil		Total		Groundwater		Soil		Total		
		CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	
BED-8	AH&P	2E+00	4E+00	2E+00	4E+00	4E+00	1E+01	5E-06	4E-05	3E-06	3E-05	7E-06	5E-05	< 0.1
CDM01b	PCA	2E+00	4E+00	7E-01	1E+00	3E+00	6E+00	5E-06	4E-05	2E-06	2E-05	7E-06	5E-05	< 0.1
CDM02	PCA	1E+01	2E+01	7E-01	1E+00	1E+01	2E+01	5E-06	4E-05	2E-06	2E-05	7E-06	5E-05	< 0.1
CDM03b	PCA	1E+02	2E+02	7E-01	1E+00	1E+02	2E+02	3E-04	3E-03	2E-06	2E-05	3E-04	3E-03	3
CDM04b	PCA	3E+00	4E+00	7E-01	1E+00	3E+00	7E+00	5E-05	4E-04	2E-06	2E-05	5E-05	4E-04	1.4
GE-MW-06	LP	7E+00	1E+01	3E+00	6E+00	1E+01	2E+01	3E-05	2E-04	9E-06	1E-04	4E-05	3E-04	0.5
GE-MW-07	PCA	5E+00	8E+00	7E-01	1E+00	5E+00	1E+01	6E-06	5E-05	2E-06	2E-05	8E-06	5E-05	< 0.1
GE-MW-08	AH&P	5E+01	8E+01	2E+00	4E+00	5E+01	8E+01	1E-04	9E-04	3E-06	3E-05	1E-04	9E-04	77
GE-MW-15	PCA	2E+01	3E+01	7E-01	1E+00	2E+01	3E+01	4E-06	3E-05	2E-06	2E-05	6E-06	4E-05	< 0.1
GE-MW-16	PCA	2E+01	3E+01	7E-01	1E+00	2E+01	3E+01	2E-05	1E-04	2E-06	2E-05	2E-05	1E-04	< 0.1
GE-MW-17	PCA	1E+01	2E+01	7E-01	1E+00	1E+01	2E+01	2E-06	1E-05	2E-06	2E-05	4E-06	3E-05	< 0.1
GW-10A	RGWRD	6E-01	1E+00	8E-02	2E-01	7E-01	1E+00	4E-06	4E-05	1E-06	2E-05	6E-06	4E-05	< 0.1
GW-8	RGWRD	1E+01	2E+01	8E-02	2E-01	1E+01	2E+01	1E-05	8E-05	1E-06	2E-05	1E-05	9E-05	< 0.1
GWCDM11	PCA	2E+00	3E+00	7E-01	1E+00	3E+00	5E+00	5E-06	4E-05	2E-06	2E-05	7E-06	5E-05	< 0.1
GWCDM12	PCA	5E+00	9E+00	7E-01	1E+00	6E+00	1E+01	5E-06	4E-05	2E-06	2E-05	7E-06	5E-05	< 0.1
--	HLP	--	--	6E-01	1E+00	6E-01	1E+00	--	--	7E-06	8E-05	7E-06	8E-05	< 0.1

Panel B. Total Metals

Exposure Units		Non Cancer HI						Cancer Risk						$P10_{fetus}$ (%) (lead)
Groundwater Well	Soil Exposure Unit	Groundwater		Soil		Total		Groundwater		Soil		Total		
		CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	
BED-8	AH&P	2E+00	4E+00	2E+00	4E+00	4E+00	9E+00	5E-06	4E-05	3E-06	3E-05	7E-06	5E-05	< 0.1
CDM01b	PCA	3E+00	5E+00	7E-01	1E+00	4E+00	7E+00	8E-06	7E-05	2E-06	2E-05	1E-05	8E-05	< 0.1
CDM02	PCA	1E+01	2E+01	7E-01	1E+00	1E+01	2E+01	6E-06	5E-05	2E-06	2E-05	8E-06	6E-05	< 0.1
CDM03b	PCA	1E+02	2E+02	7E-01	1E+00	1E+02	2E+02	5E-04	4E-03	2E-06	2E-05	5E-04	4E-03	6
CDM04b	PCA	1E+01	2E+01	7E-01	1E+00	1E+01	2E+01	3E-04	2E-03	2E-06	2E-05	3E-04	2E-03	86
GE-MW-06	LP	7E+00	1E+01	3E+00	6E+00	1E+01	2E+01	3E-05	3E-04	9E-06	1E-04	4E-05	3E-04	0.8
GE-MW-07	PCA	5E+00	8E+00	7E-01	1E+00	6E+00	1E+01	5E-06	4E-05	2E-06	2E-05	7E-06	5E-05	< 0.1
GE-MW-08	AH&P	5E+01	8E+01	2E+00	4E+00	5E+01	9E+01	1E-04	9E-04	3E-06	3E-05	1E-04	1E-03	81
GE-MW-15	PCA	1E+01	2E+01	7E-01	1E+00	1E+01	3E+01	--	--	2E-06	2E-05	2E-06	2E-05	< 0.1
GE-MW-16	PCA	2E+01	3E+01	7E-01	1E+00	2E+01	4E+01	2E-05	2E-04	2E-06	2E-05	2E-05	2E-04	< 0.1
GE-MW-17	PCA	1E+01	2E+01	7E-01	1E+00	1E+01	2E+01	2E-06	1E-05	2E-06	2E-05	4E-06	3E-05	< 0.1
GW-10A	RGWRD	7E-01	1E+00	8E-02	2E-01	8E-01	1E+00	6E-06	5E-05	1E-06	2E-05	8E-06	6E-05	< 0.1
GW-8	RGWRD	1E+01	2E+01	8E-02	2E-01	1E+01	2E+01	2E-05	2E-04	1E-06	2E-05	3E-05	2E-04	< 0.1
GWCDM11	PCA	5E+00	7E+00	7E-01	1E+00	5E+00	1E+01	1E-05	8E-05	2E-06	2E-05	1E-05	9E-05	< 0.1
GWCDM12	PCA	5E+00	8E+00	7E-01	1E+00	5E+00	1E+01	1E-05	8E-05	2E-06	2E-05	1E-05	9E-05	< 0.1
--	HLP	--	--	6E-01	1E+00	6E-01	1E+00	--	--	7E-06	8E-05	7E-06	8E-05	< 0.1

Shaded cells indicate locations where noncancer risks exceed an HI of 1E+00 or a cancer risk of 1E-04 or a P10 value of 5%.

Total Risk = RME (exposure pathway with maximum risk) + (30/9)*CTE (all other exposure pathways)

Table ES-8.
Risks to Hypothetical Future Construction Workers from Incidental Ingestion and Inhalation of On-Site Soils

Exposure Unit	HI		Cancer Risk		$P10_{fetus}$ % (lead risk)
	CTE	RME	CTE	RME	
AH&P	8E+00	2E+01	1E-06	6E-06	<0.1
HLP	4E+00	9E+00	5E-06	2E-05	0.4
LP	2E+01	5E+01	1E-05	5E-05	1.1
PCA	4E+00	8E+00	1E-06	6E-06	<0.1
RGWRD	1E+01	3E+01	1E-06	5E-06	<0.1

Shaded cells indicate locations where noncancer risks exceed an HI of 1E+00 , a cancer risk of 1E-04, or a P10 value of 5%.

Table ES-9.

Risks to Children from Surface Water and Sediment in Off-Site Drainages

Exposure Unit	Non Cancer HI						Cancer Risk						P10 (%) (lead)
	Surface Water		Sediment		Total		Surface Water		Sediment		Total		
	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	
BBC0	7E-04	2E-02	6E-02	2E-01	6E-02	2E-01	2E-09	2E-07	4E-07	5E-06	4E-07	5E-06	< 0.1
BBC1	7E-04	3E-02	6E-02	3E-01	7E-02	3E-01	1E-09	1E-07	5E-07	6E-06	5E-07	6E-06	< 0.1
BBC2	7E-04	2E-02	5E-02	2E-01	5E-02	2E-01	2E-09	2E-07	3E-07	4E-06	3E-07	4E-06	< 0.1
BBC3	9E-04	3E-02	1E-01	4E-01	1E-01	4E-01	1E-09	1E-07	7E-07	9E-06	7E-07	9E-06	< 0.1
BBC4	6E-04	2E-02	1E-01	6E-01	1E-01	6E-01	9E-10	1E-07	1E-06	2E-05	1E-06	2E-05	< 0.1
BHG	7E-04	3E-02	2E-02	7E-02	2E-02	7E-02	2E-09	3E-07	6E-08	7E-07	6E-08	7E-07	< 0.1
BKD1	4E-04	1E-02	3E-02	1E-01	3E-02	1E-01	1E-09	1E-07	3E-07	3E-06	3E-07	3E-06	< 0.1
BMG	4E-04	1E-02	4E-02	1E-01	4E-02	2E-01	7E-10	8E-08	5E-08	6E-07	5E-08	6E-07	< 0.1
CC	8E-04	3E-02	2E-02	1E-01	3E-02	1E-01	3E-09	3E-07	8E-08	1E-06	9E-08	1E-06	< 0.1
HG	9E-03	3E-01	1E-01	4E-01	1E-01	5E-01	2E-08	2E-06	7E-07	9E-06	8E-07	9E-06	< 0.1
OFA	2E-03	5E-02	2E-01	7E-01	2E-01	7E-01	2E-09	2E-07	8E-07	9E-06	8E-07	9E-06	< 0.1
RG	2E-02	8E-01	7E-02	3E-01	9E-02	1E+00	2E-09	2E-07	5E-07	7E-06	5E-07	7E-06	< 0.1
SC2	1E-03	4E-02	9E-02	3E-01	9E-02	3E-01	7E-10	8E-08	5E-07	6E-06	5E-07	6E-06	< 0.1
SC3	8E-04	3E-02	7E-02	3E-01	7E-02	3E-01	9E-10	9E-08	5E-07	6E-06	5E-07	6E-06	< 0.1
SC4	7E-04	3E-02	1E-01	4E-01	1E-01	4E-01	9E-10	1E-07	6E-07	8E-06	6E-07	8E-06	< 0.1
TG	6E-04	2E-02	2E-02	7E-02	2E-02	8E-02	1E-09	1E-07	2E-08	3E-07	2E-08	3E-07	< 0.1

Shaded cells indicate locations where noncancer risks exceed an HI of 1E+00 , a cancer risk of 1E-04, or a P10 value of 5%.

Total Risk = RME (exposure pathway with maximum risk) + (30/9)*CTE (all other exposure pathways)

Table ES-10

Risks to Recreational Fisherman from Surface Water, Sediment, and Fish in Off-Site Drainages

Exposure Unit	Non Cancer HI								Cancer Risk								$P10_{fetus}$ (%) (lead)
	Surface Water		Sediment		Fish		Total		Surface Water		Sediment		Fish		Total		
	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	
BBC0	1E-05	1E-03	6E-04	6E-03	3E-03	5E-02	4E-03	6E-02	1E-10	4E-08	1E-08	5E-07	7E-08	4E-06	8E-08	4E-06	< 0.1
BBC1	2E-05	1E-03	7E-04	7E-03	5E-03	8E-02	6E-03	8E-02	7E-11	2E-08	2E-08	6E-07	1E-07	5E-06	1E-07	5E-06	< 0.1
BBC2	1E-05	1E-03	6E-04	6E-03	4E-03	7E-02	5E-03	7E-02	1E-10	4E-08	1E-08	4E-07	8E-08	5E-06	9E-08	5E-06	< 0.1
BBC3	2E-05	2E-03	1E-03	1E-02	6E-03	9E-02	7E-03	1E-01	1E-10	3E-08	3E-08	1E-06	9E-08	5E-06	1E-07	5E-06	< 0.1
BBC4	1E-05	1E-03	1E-03	2E-02	8E-03	1E-01	1E-02	1E-01	7E-11	2E-08	5E-08	2E-06	9E-08	5E-06	1E-07	5E-06	< 0.1
BHG	1E-05	1E-03	2E-04	2E-03	--	--	2E-04	2E-03	2E-10	6E-08	2E-09	8E-08	--	--	2E-09	8E-08	< 0.1
BKD1	9E-06	8E-04	3E-04	3E-03	--	--	3E-04	3E-03	9E-11	3E-08	9E-09	3E-07	--	--	9E-09	3E-07	< 0.1
BMG	8E-06	8E-04	4E-04	4E-03	2E-03	3E-02	2E-03	3E-02	5E-11	2E-08	2E-09	7E-08	4E-08	2E-06	4E-08	2E-06	< 0.1
CC	2E-05	2E-03	3E-04	3E-03	--	--	3E-04	3E-03	2E-10	7E-08	3E-09	1E-07	--	--	3E-09	1E-07	< 0.1
HG	2E-04	2E-02	1E-03	1E-02	--	--	1E-03	2E-02	2E-09	5E-07	3E-08	9E-07	--	--	3E-08	9E-07	< 0.1
OFA	3E-05	3E-03	2E-03	2E-02	--	--	2E-03	2E-02	2E-10	5E-08	3E-08	1E-06	--	--	3E-08	1E-06	< 0.1
RG	5E-04	4E-02	7E-04	7E-03	--	--	1E-03	5E-02	1E-10	5E-08	2E-08	7E-07	--	--	2E-08	7E-07	< 0.1
SC2	2E-05	2E-03	9E-04	9E-03	4E-03	6E-02	4E-03	6E-02	5E-11	2E-08	2E-08	6E-07	9E-08	5E-06	1E-07	5E-06	< 0.1
SC3	2E-05	2E-03	8E-04	8E-03	--	--	8E-04	8E-03	6E-11	2E-08	2E-08	6E-07	--	--	2E-08	6E-07	< 0.1
SC4	1E-05	1E-03	1E-03	1E-02	4E-03	7E-02	5E-03	7E-02	7E-11	2E-08	2E-08	8E-07	9E-08	5E-06	1E-07	5E-06	< 0.1
TG	1E-05	1E-03	2E-04	2E-03	--	--	2E-04	2E-03	7E-11	2E-08	8E-10	3E-08	--	--	9E-10	3E-08	< 0.1

Shaded cells indicate locations where noncancer risks exceed an HI of 1E+00 , a cancer risk of 1E-04, or a P10 value > 5%.

Total Risk = RME (exposure pathway with maximum risk) + (30/9)*CTE (exposure pathway)

Table ES-11.
Risks to Residents from Ingestion of Groundwater
Along Off-Site Drainages

Panel A: Dissolved Metals

Well	HI		Cancer Risk		P10 %
	CTE	RME	CTE	RME	(lead)
BED11	7E+00	2E+01	2E-05	2E-04	<0.1
BED-14	5E+00	1E+01	2E-05	2E-04	<0.1
BED-19	1E-01	2E-01	--	--	2
BED-7	5E+00	1E+01	4E-05	3E-04	<0.1
BES-11	5E+00	1E+01	3E-05	2E-04	<0.1
BES-14	5E+00	1E+01	2E-05	2E-04	<0.1
BES-17	8E+00	2E+01	1E-04	8E-04	<0.1
CDM06b	4E-01	9E-01	--	--	<0.1
GE-MW-18	7E-01	1E+00	8E-06	6E-05	<0.1
GE-MW-19	3E-01	5E-01	8E-06	6E-05	<0.1
GW-6	2E+01	4E+01	2E-05	2E-04	<0.1
GW-7	1E+01	3E+01	3E-05	2E-04	<0.1
GW-8A	6E+00	1E+01	3E-05	2E-04	<0.1
GW-9A	6E+00	1E+01	4E-05	3E-04	<0.1
GWCDM09	1E+01	3E+01	3E-05	2E-04	<0.1
GWCDM10	1E+01	3E+01	2E-05	2E-04	<0.1
GWCDM14	3E+01	7E+01	8E-05	6E-04	<0.1

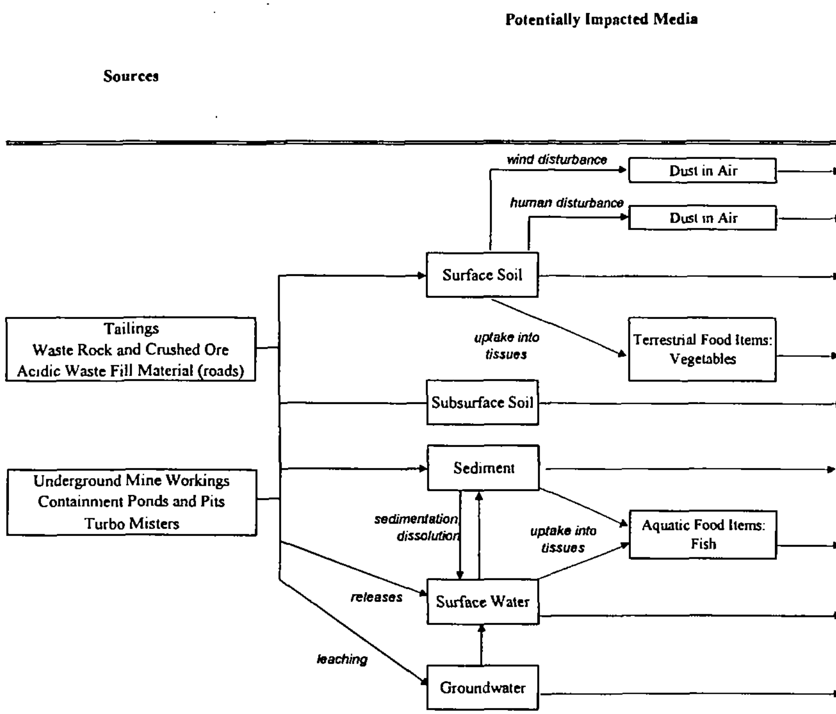
Panel B: Total Metals

Well	HI		Cancer Risk		P10 %
	CTE	RME	CTE	RME	(lead)
BED11	7E+00	2E+01	2E-05	2E-04	<0.1
BED-14	6E+00	1E+01	2E-05	2E-04	<0.1
BED-19	3E-01	6E-01	--	--	12
BED-7	5E+00	1E+01	4E-05	3E-04	<0.1
BES-11	1E+01	2E+01	3E-04	2E-03	0.4
BES-14	6E+00	1E+01	2E-05	2E-04	<0.1
BES-17	2E+01	4E+01	9E-04	6E-03	<0.1
CDM06b	4E-01	9E-01	--	--	<0.1
GE-MW-18	4E+00	9E+00	2E-05	2E-04	1.6
GE-MW-19	5E-01	1E+00	8E-06	6E-05	<0.1
GW-6	1E+01	3E+01	6E-05	4E-04	<0.1
GW-7	2E+01	3E+01	2E-05	2E-04	<0.1
GW-8A	1E+01	2E+01	4E-05	3E-04	4.3
GW-9A	6E+00	1E+01	4E-05	3E-04	<0.1
GWCDM09	2E+01	3E+01	4E-05	3E-04	<0.1
GWCDM10	1E+01	3E+01	2E-05	2E-04	<0.1
GWCDM14	4E+01	8E+01	1E-04	1E-03	<0.1

-- Arsenic not measured in groundwater samples at this well, thus cancer risk estimates are not available at this location.

Shaded cells indicate locations where noncancer risks exceed an HI of 1E+00, a cancer risk of 1E-04, or a P10 value of 5%.

Figure ES-1. Site Conceptual Model for Human Exposure



Exposed Population

Medium	Exposure Route	On-Site (Mine Facility): Recreational Visitors – ATV Rider	On-Site: Recreational Visitors – Hiker	On-Site: Construction Worker[a]	On-Site: Commerical Workers[a]	On-Site: Residents[a]	Off-Site (Riparian Areas): Recreational Fisherman (Adult)	Off-Site: Residential Child (7-12 years)	Off-Site: Resident
Dust in Air (wind disturbance)	Inhalation	X	X	X	X	X			
Dust in Air (human disturbance)	Inhalation	●		●					
Surface Soil	Ingestion	●	●	●	●	●			
Surface Soil	Dermal	X	X	X	X	X			
Terrestrial Food Items: Vegetables	Ingestion					X			
Subsurface Soil	Ingestion			●					
Subsurface Soil	Dermal			X					
Sediment	Ingestion		●				●	●	
Sediment	Dermal		X				X	X	
Aquatic Food Items: Fish	Ingestion						●		
Surface Water	Ingestion		●				●	●	
Surface Water	Dermal		X				X	X	
Groundwater	Ingestion				●	●			●

LEGEND

●	Pathway is complete and might be significant; sufficient data are available for quantitative evaluation
X	Pathway is or may be complete, however, risk is low or data are lacking. Qualitative evaluation only.
	Pathway is not complete; no evaluation required

Notes:

[a] Currently, this exposure pathway is incomplete; however, future hypothetical exposures will be evaluated.

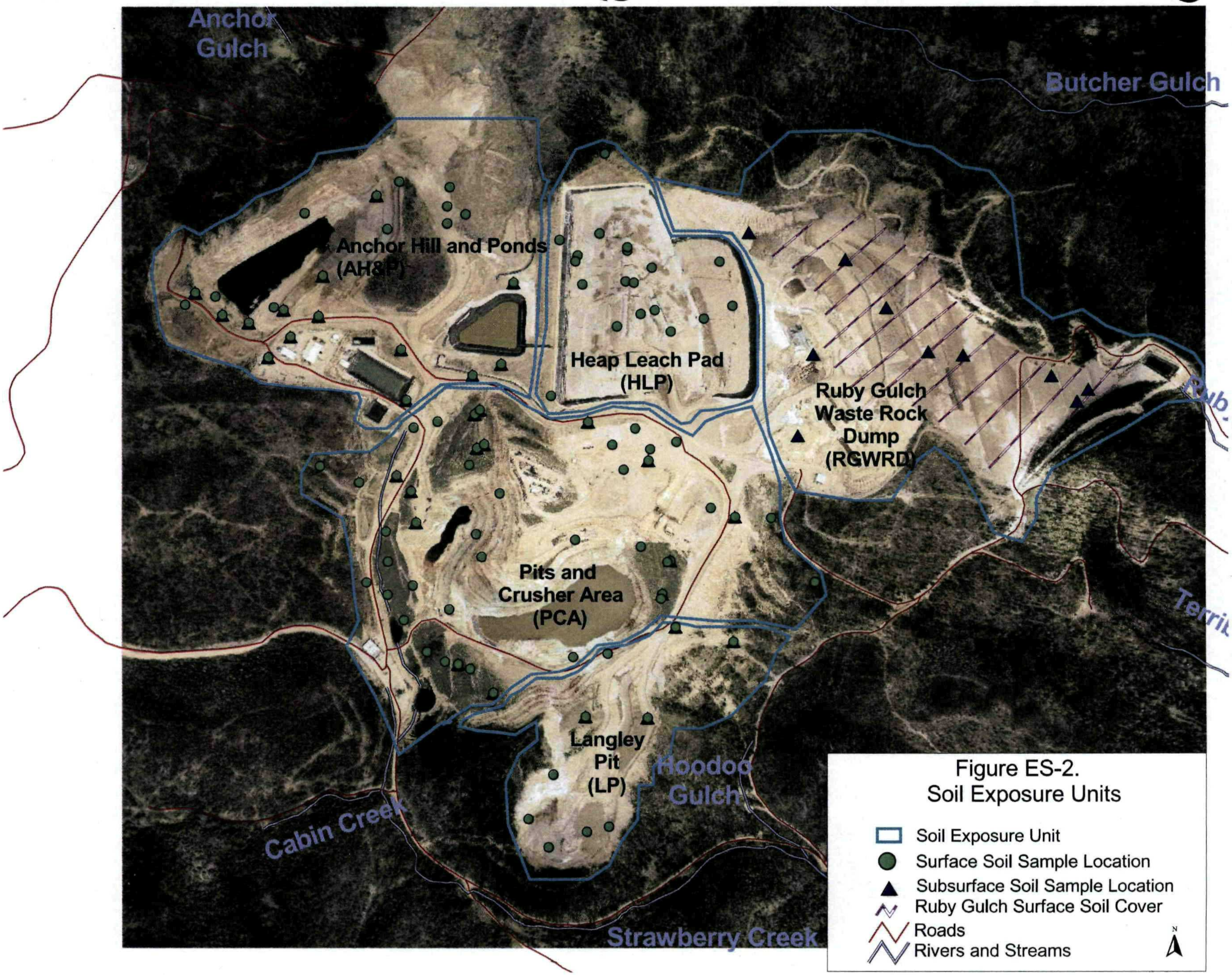


Figure ES-2.
Soil Exposure Units

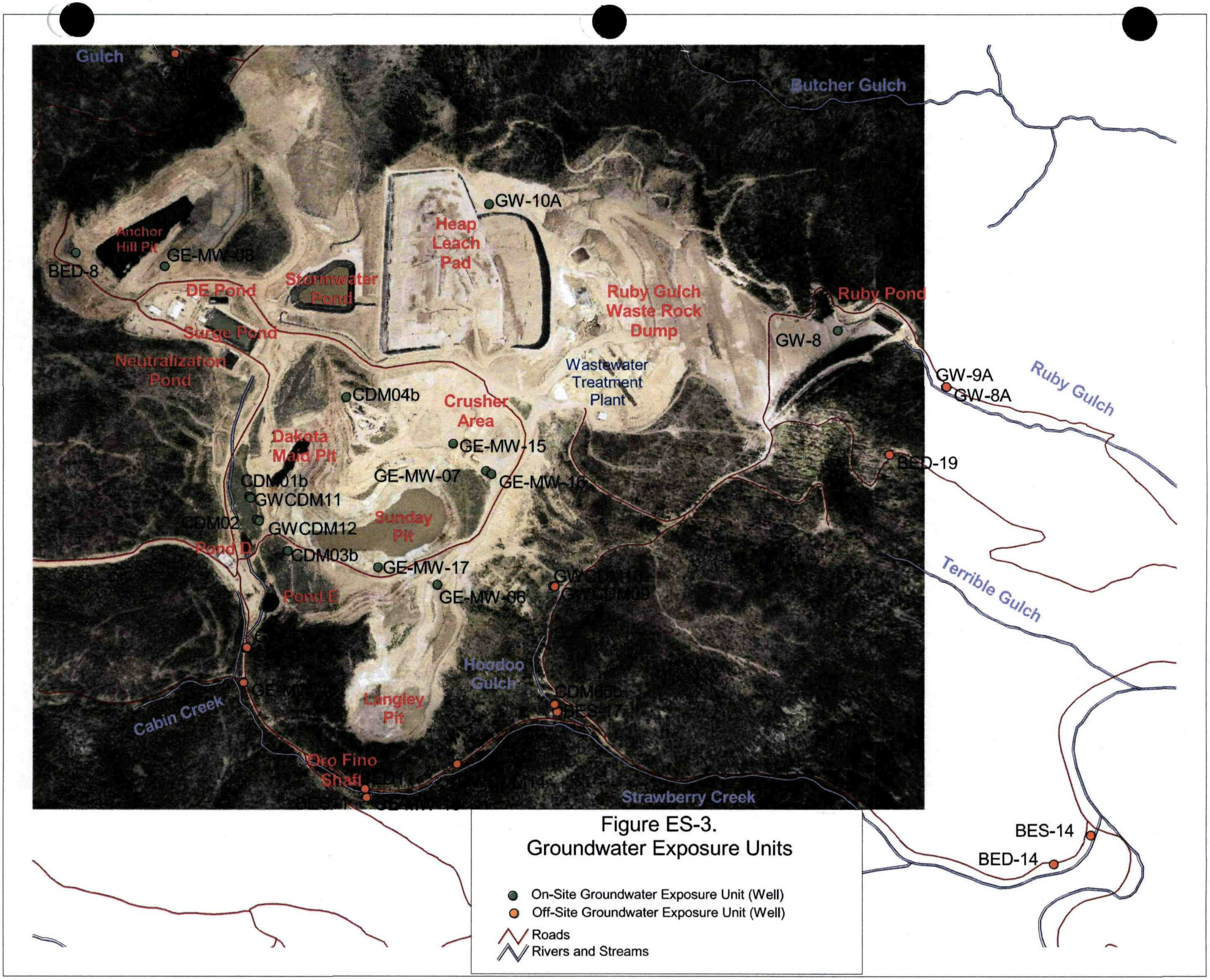


Figure ES-3.
Groundwater Exposure Units

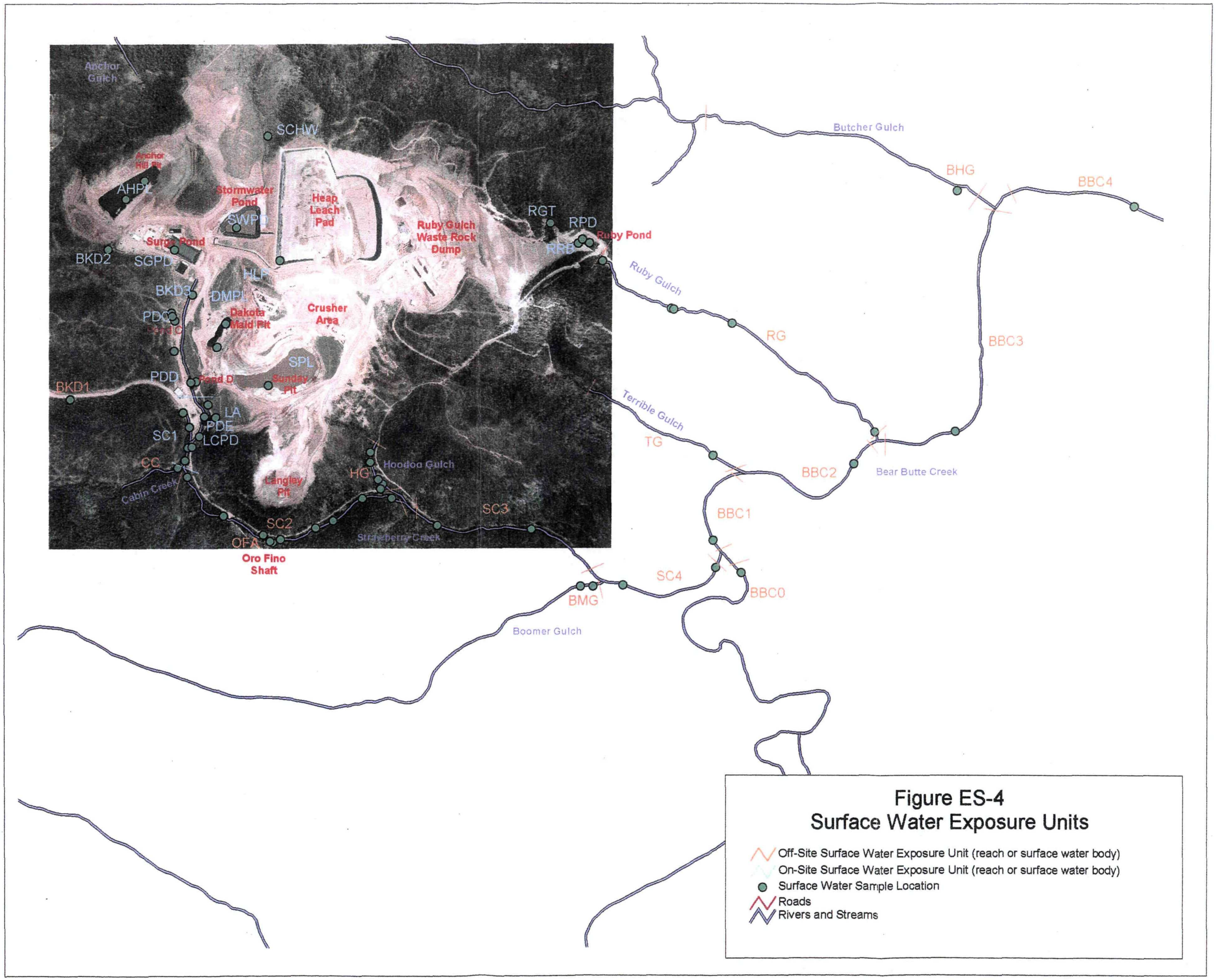


Figure ES-4
Surface Water Exposure Units

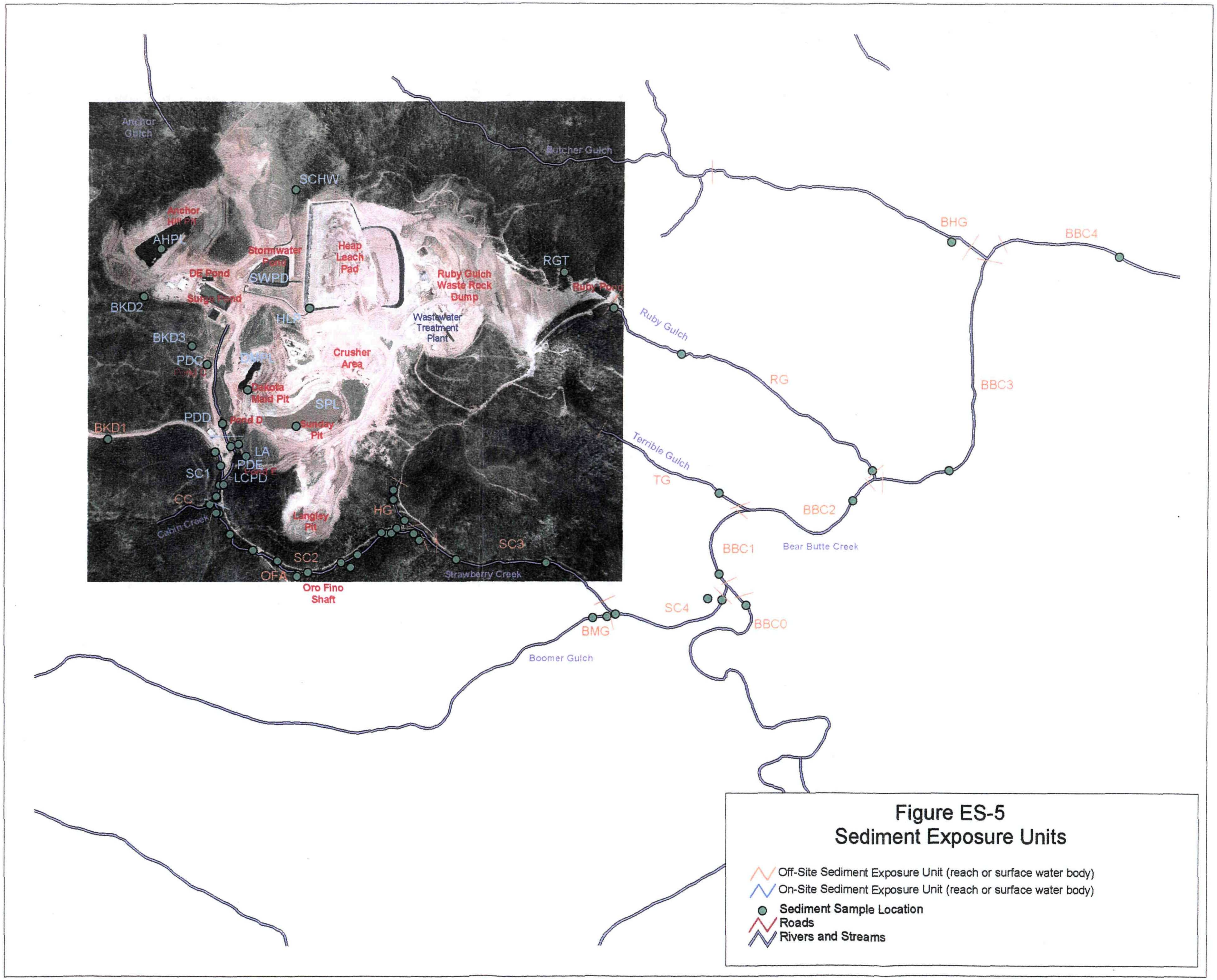


Figure ES-5
Sediment Exposure Units

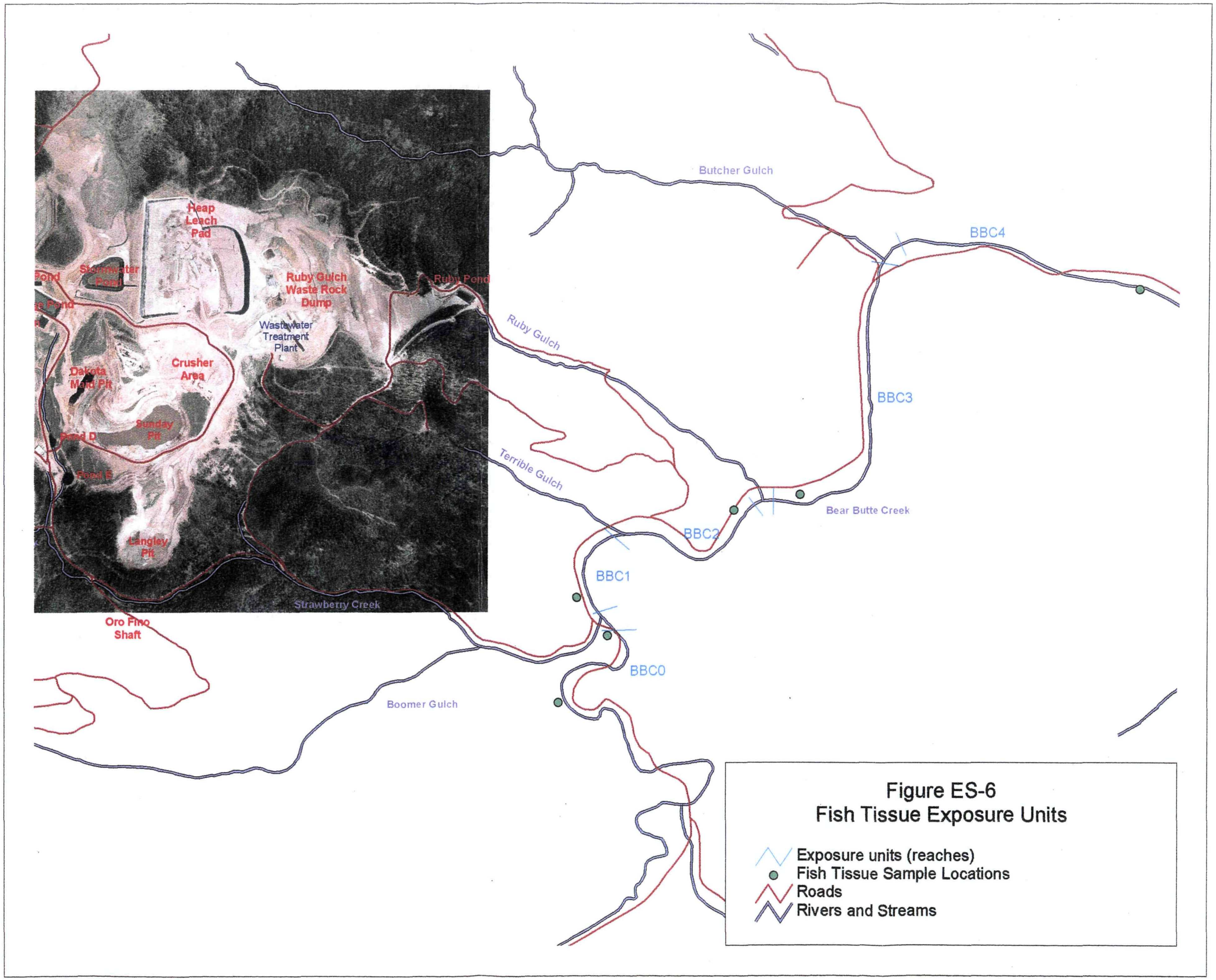


Figure ES-6
Fish Tissue Exposure Units

1.0 INTRODUCTION

1.1 Purpose

This document is a baseline human heath risk assessment (BHHRA) for the Gilt Edge Mine Superfund site in Lawrence County, South Dakota. The purpose of this document is to assess the potential risks to humans, both now and in the future, from site-related contaminants present in environmental media, assuming that no steps are taken to remediate the environment or to reduce human contact with contaminated environmental media.

The results of this assessment are intended to help inform risk managers and the public about potential human risks attributable to site-related contaminants and to help determine if there is a need for action at the site (USEPA 1989). The overall management goal is to ensure protection of humans from deleterious effects of acute and chronic exposures to site-related chemicals for both current and future land uses.

The methods used to evaluate risks in this assessment are consistent with current USEPA guidelines for human health (USEPA 1989; 1991a; 1991b; 1992a; 1993; 2002a; 2002b; 2004e) provided by the USEPA for use at Superfund sites.

1.2 Organization

In addition to this introduction, this report is organized into the following sections:

Section 2 This section provides a description of the site and a review of data that characterize the nature and extent of environmental contamination at the site.

Section 3 This section identifies human exposure scenarios of potential concern at the site, identifies chemicals of potential concern (COPCs) for each exposure scenario, and derives quantitative estimates of exposure for those pathways that are most likely to be significant.

Section 4 This section summarizes the characteristic cancer and non-cancer health effects associated with the COPCs at the site and lists the quantitative toxicity factors used to calculate cancer and non-cancer risk levels in exposed humans.

Section 5 This section provides quantitative estimates of cancer and non-cancer risk to humans exposed to site-related contaminants by each of the exposure scenarios of primary concern.

Section 6	This section identifies the primary sources of uncertainty in the estimated levels of human health risk, and discusses the likely magnitude and direction of the error attributable to these uncertainties.
Section 7	This section provides full citations for USEPA guidance documents, site-related documents, and scientific publications referenced in the baseline risk assessment.

2.0 SITE CHARACTERIZATION

2.1 Site Location and Description

The Gilt Edge Mine Superfund Site is located in the mining district in the Black Hills of South Dakota (Figure 2-1), approximately 4.5 miles south-southeast from the town of Lead (CDM 2004). The Site is an abandoned 258-acre open pit gold mine, developed in highly sulfidic rock. The Gilt Edge Mine is located immediately adjacent to the upper reaches of Strawberry Creek (Figure 2-2).

2.2 Site History

A detailed description of operations at the Gilt Edge Mine Site is provided in the closure plan prepared by the Bureau of Reclamation (BOR) (BOR 2000). A brief overview of site operations is provided below.

The Gilt Edge site is a former mining and processing site that has been mined intermittently by several owners, since the late 1800s. Cyanide leaching, mercury amalgamation, and zinc precipitation were among the methods used to recover gold (USEPA 2001a). Mining operations began at the Site in 1876 when the original claims were located and underground mining was initiated. Mining operations expanded in the 1930s, including addition of a mill. Tailings from these milling operations were discharged to Strawberry Creek. The most recent phase of operations commenced in the mid-1980s, with the mining of the Dakota Maid and Sunday Pits from 1987 to 1992. The Anchor Hill and Langley Pits were subsequently developed in 1996 and 1997. This latest stage of mining included use of the cyanide heap leaching process. The Site was abandoned in 1998 when the Site operator declared bankruptcy. In 1999, the State of South Dakota took over operation of water treatment facilities. EPA assumed water treatment operation in August 2000 under the EPA Region 8 Emergency Response Program. The Site was added to the National Priorities List (NPL) on December 1, 2000 (CDM 2003).

2.3 Site Features

Many surface features associated with mining and processing operations remain at the Site. These features include open pit mine excavations, underground mine workings, a heap leach pad, ore processing equipment (piping, impoundments, etc.), waste rock dumps, and surface water flow management structures (ponds, drainages, and treatment facilities) (CDM 2003). The locations of these features are shown in Figure 2-2 and are described below.

2.3.1 Open Pits

As seen in Figure 2-2, there are four open pits at the site:

- ***Sunday Pit.*** This 29.5 acre, 240-foot deep, pit that was excavated below the water table in the bedrock aquifer, contains water affected by acid rock drainage (ARD). It is the principal storage reservoir for acid water prior to treatment. In 1999 and 2000, the pit was also used as a repository for sludge disposal generated from the on-site water treatment plant. There are extensive underground mine workings beneath the Sunday Pit. The degree of connectivity of these workings to the pit is unknown (BOR 2000, CDM 2003).

- ***Dakota Maid Pit.*** A 17.1 acre, 250-foot deep, pit was excavated below the water table in the bedrock aquifer (BOR 2000; CDM 2003). The pit is used to store ARD water for treatment. Water is pumped from Dakota Maid pit to the Sunday Pit for storage and eventual treatment (EPA 2001). An earthen dam on the east side of the pit leaks, conveying ARD water to the ponds along Strawberry Creek. Historic underground workings are known to interconnect with the pit and influence its water levels (BOR 2000, CDM 2003).

- ***Anchor Hill Pit.*** This 23.6 acre, 120-foot deep, pit is a temporary storage area for ARD water (BOR 2000, CDM 2003x). Water is pumped from the Anchor Hill Pit to the Sunday pit storage and treatment (EPA 2001).

- ***Langely Pits.*** These two pits (north and south) do not contain any ARD water. The south pit is approximately 8.1 acre pit that has been partially backfilled with waste rock. The north pit is considerably smaller and a portion of the pit has already been reclaimed by Brohm Mining Company (BOR 2000, CDM 2003).

2.3.2 Underground Mine Workings

As seen in Figure 2-3, there are underground mine workings (shafts, adits, etc.) present primarily in the central portion of the site, near the Dakota Maid and Sunday Pits. Some of these structures have been observed to discharge water, including the King Adit, wood weir and Langley Tunnel. The King Adit is accessible from the Dakota Maid Pit and controls the water level in the pit (BOR 2000). The wood weir and Langley Tunnel drain to Pond E (CDM 2003).

2.3.3 Heap Leach Pad

The Heap Leach Pad (see Figure 2-2) covers 37 acres and contains approximately 3.2 million tons of spent ore. Two eastward expansions to this pad were built; however, no ore was processed on the last expansion pad. The heap leach pad and expansion areas consist of asphalt and several types of polyethylene and soil composite liner materials (EPA 2001b).

2.3.4 Mine Process Water System

The mine process water system is located south of the Anchor Hill Pit on 14.5 acres and consists of plant buildings and ponds. The system transports solutions that are recovered from a sump located in the southwest corner of the leach pad by polyethyrene piping to the process plant for treatment. Plant components include a reverse osmosis treatment facility and a cyanide neutralization building. A Surge Pond, Neutralization Pond and Diatomaceous Earth Pond are located near the plant and are used to manage process fluids. These ponds are constructed with high density polyethylene (HDPE) primarily liners and HDPE/soil composite secondary liners. A French drain, underlying the plant facility discharges to Pond C (EPA 2001b, CDM 2003).

2.3.5 Ruby Gulch Waste Rock Repository

This 59.1 acre area is estimated to contain 20 million tons of waste rock and 4.2 million tons of spent ore. The Ruby Gulch Waste Rock Repository (Ruby Repository) was a significant source of ARD. This area has been capped as a part of remedial actions associated with OU3 (CDM 2003a, EPA 2001a).

2.3.6 Surface Water Management Systems

An ARD wastewater treatment plant and several small detention ponds comprise the surface water management system at the site. Each of these is briefly discussed below.

- ***An ARD Wastewater Treatment Plant.*** The plant is located on the southwest edge of the Ruby Repository and utilizes a Lime-High Density Sludge (HDS) precipitation system to treat ARD water. Effluent is discharged to Strawberry Creek at a point immediately southwest of Pond E. The old sodium-hydroxide treatment plant was decommissioned in Fall 2002, replaced by the new plant, and water treatment resumed in late 2003. Sludge from the old treatment plant was discharged into the Sunday Pit and also the Stormwater Pond (2000 – 2002). The lime-HDS plant sludge is now discharged into a lined cell within the Heap Leach Pad east-extension area.

- ***Ruby Repository.*** The Ruby ARD outflow used to discharge into a surface impoundment at the toe of the waste-rock dump. In 2005, construction was completed on the toe-buttress and a new ARD underground storage tank (UST) and pumphouse facility. The UST collects the ARD flowing into the toe or the repository, and the ARD is pumped (via the upgraded Ruby Pumphouse) to the Sunday pit for storage prior to treatment at the onsite ARD wastewater treatment plant.

- ***Stormwater Pond.*** This containment pond was used to collect and store runoff from the heap leach pad and now stores ARD water and sludge from the water treatment plant (CDM 2003a).

- ***Pond C.*** Pond C is one of several small detention ponds located in the Strawberry Creek Drainage. It detains clean water from the north end of the site (bypassing the mining area) and releases it to Strawberry Creek. It also collects water from some ARD seeps.

- ***Pond D.*** Pond D is one of several small detention ponds located in the Strawberry Creek Drainage. This pond collects water from the King Shaft (underground mine works beneath the Dakota Maid Pit) and discharges to Pond E.

- ***Pond E.*** Pond E is one of several small detention ponds located in the Strawberry Creek Drainage. Pond E collects ARD water from Pond D, the wood weir adit and the Langley tunnel. The Strawberry Pond Pumphouse transfers water from Pond E to the onsite wastewater treatment plant.

2.4 Topography

The Gilt Edge Mine Site is located in mountainous terrain consisting of somewhat rounded hills transected by narrow, deeply incised valleys. Elevations range from 4,780 to 5,700 feet, with most mining features located between elevations of 5,200 and 5,600 feet (CDM 2003a).

2.5 Climate

Temperatures at the Gilt Edge Mine Site range from highs near 100 degrees Fahrenheit (^{o}F) in the summer to lows of -20^{o}F in the winter. An average of 29 inches of precipitation is received annually at the mine site. Regional evapotranspiration estimates suggest an evaporation loss of around 19 inches per year (CDM 2003a). Winds are generally out of the northwest at approximately 10 to 13 miles per hour (USEPA 2001a).

Freezing temperatures accompanied by snow are normal in late October. The average annual snowfall measured at Deadwood is 97.1 inches. Frost depth is approximately 48 inches (CDM 2003a).

2.6 Groundwater

Site groundwater consists of a shallow unconfined alluvial system and an unconfined, fractured bedrock system. A detailed description of groundwater is provided in the Groundwater Characterization Report for the site (CDM 2003a). A brief overview of these systems is provided below.

Alluvial Groundwater System

The shallow alluvial unit is unconfined and consists of saturated alluvial and colluvial materials in the bottom of the stream valleys. The most significant occurrences of this unit are along Strawberry Creek, Bear Butte Creek, and, to a lesser extent, Ruby Gulch. The alluvium thins in some areas of Strawberry Creek downgradient of the Site to the point where bedrock is exposed in the channel. Unconsolidated accumulations of man-placed fill material are also considered to be part of the alluvial unit. The most extensive areas of fill include the Ruby waste rock dump, the Heap Leach Pad and fill in the upper reach of Strawberry Creek from the process area to the mine office. These deposits are moderately permeable and convey significant quantities of water that infiltrate from the site. Groundwater at the site typically flows downward towards the bedrock. Lateral flow of groundwater in alluvial deposits also occurs. The hydraulic conductivity of alluvial deposits ranges from 4 to 94 feet per day, with most values less than 4 ft/day. The flow exiting the site in the alluvium is estimated to be less than 3 gallons per minute (CDM 2003a).

Bedrock Aquifer

The bedrock units at the Site contain little, if any, primary or intergranular permeability. Thus, occurrence and movement of groundwater within these materials is controlled by fractures in the bedrock, as well as open bedding/follation planes, faults, shears, and the underground mine workings. The bedrock aquifer is generally unconfined. However, due to the nature of the fractured flow system, confined conditions can be expected to occur locally and in areas of lower topography. Groundwater flow in the bedrock aquifer is generally controlled by topography and the location of streams and is generally to the east and southeast. The bedrock potentiometric surface gradient is approximately 0.087 foot/foot, and the mean transmissivity for bedrock wells is less than 3 square feet per day (ft^2/day) (CDM 2003a).

2.7 Surface Water

On-site surface water bodies include mine-related detention ponds and mining pit lakes. The mine site is dissected by steep drainage valleys, or gulches, including: Hoodo Gulch, Terrible Gulch, Ruby Gulch, and Boomer Gulch. The mine site is at the head of Ruby Gulch, Terribly Gulch, Hoodo Gulch and Strawberry Creek. Strawberry Creek flows southeastward into Bear Butte Creek. Rainwater runoff from the mine site also flows from Ruby Gulch into Bear Butte Creek. Bear Butte Creek flows from southwest to northeast, through the community of Galena, to the city of Sturgis via Boulder Canyon (ATSDR 2005).

Strawberry Creek and Bear Butte Creek are classified by the State of South Dakota as:

- cold water marginal (Strawberry Creek) and cold water permanent (Bear Butte Creek) fish life propagation waters
- limited-contact recreation waters

- fish and wildlife propagation, recreation, and stock watering waters
- irrigation waters (USEPA 2001a).

2.8 Land Use

Current On-Site Land Use

Currently the Site is an abandoned hard rock mine. The main entrance to the site is fenced and gated, and access is restricted to government/contractor staff. The Site and surrounding area are zoned as a Park Forest District (PF) by Lawrence County. Permitted land uses include:

- Detached single-family dwellings, cabins, and summer homes;
- Transportation and utility easements, alleys, and right-of-way;
- Public parks an/or playgrounds;
- Historical monuments or structures;
- Utilities substations;
- Plant nursery;
- Tree or crop growing areas and grazing lands;
- Other uses approved under county and state conditional use permits (USEPA 2001a).

On-site surface water is not used for drinking or for other domestic purposes (ATSDR 2005).

Future On-Site Land Use

Proposed future land uses of the Gilt Edge Site include recreational (hiking, cross country skiing, hunting, nature preserve, off-road vehicle use, snowmobiling, shooting range), commercial (Native American Cultural Center, shooting range, golf course, Rehabiltiation/Retreat Facilities) and residential uses (Mann Stragetgies, Inc. 2005).

Surrounding Land Use

The Site is primarily surrounded by National Forest land. Two residential areas are located within the vicinity of the Site. The first residential area is the community of Galena, located approximately 0.6 miles southeast of the Site (see Figure 2-1). There are approximately 20-25 residents in Galena, with homes along Bear Butte Creek. Galena residents obtain their drinking water from private wells. The second residential area is a group of 5-7 homes located west (upgradient) of the Site along Forest Route 534, an unpaved road connecting Highway 385 to the mining area (ATSDR 2005). These residents also obtain their drinking water from private wells (CDM 2006).

2.9 Response Actions

Remedial response actions that have been completed at the site to date have included:

- Replacing the Brohm Mining Corporation-built water treatment plant in 2002-2003 (EPA 2001b)
- Capping the Ruby Gulch Waste Rock Repository (Ruby Repository) in 2003 (EPA 2001b)

2.10 Site Investigations

A number of studies have been performed at the site to characterize the nature and extent of contamination at the site. Investigations relevant to current site conditions were provided in an electronic database format by CDM Federal and are summarized in Table 2-1. The data include measures of the concentration of metals and other chemicals in surface soil, subsurface soil, groundwater, surface water, sediment and fish tissue samples collected at and adjacent to the Gilt Edge Mine Site from September 2000 to August 2005. Figures 2-4 through 2-9 present the sample locations for each media.

Note that the investigations described above were completed prior to the placement of a cap at the Ruby Gulch Waste Repository. Thus, in order to estimate surface soil concentrations at the Ruby Gulch Waste Repository, soil samples that were collected from the on-site soil stockpiles (see Figure 2-10, stockpiles 1, 3, 6, and 7) that were used as the surface cover material (0-6") at the Repository were used (see Figure 2-4) as the surface soil data set for this area of the site. These data are considered to be representative of current surface soil conditions at the Ruby Repository. Surface soil samples collected from the Ruby Gulch Waste Rock Repository prior to the completion of the cap are classified as sub-surface soil samples, as they are currently located beneath the Repository cap.

The analytical data used in this risk assessment are provided electronically in Appendix A. Summary statistics of chemicals measured in environmental and biotic media are provided in Tables 2-2 through 2-7.

3.0 EXPOSURE ASSESSMENT

Exposure is the process by which human or ecological receptors come into contact with chemicals in the environment. In general, receptors can be exposed to chemicals in a variety of environmental media (e.g., soil, water, air, food), and these exposures can occur through several pathways (e.g., ingestion, dermal contact, inhalation). Section 3.1 identifies exposure pathways that could lead to contact with site-related contaminants at this site, and Section 3.2 identifies which of these are believed to be most significant at this site. Section 3.3 identifies chemicals of potential concern, and Sections 3.4 and 3.5 describe the methods used to quantify exposure from each pathway that is considered to be of possible significance and describe the selection of exposure points and calculation of exposure concentrations for human and ecological receptors, respectively.

3.1 Site Conceptual Model

Figure 3-1 presents the site conceptual model of how chemicals that may have been released from the Gilt Edge Mine Site might result in exposure of human receptors.

For the purpose of this risk assessment, the Gilt Edge Mine site is divided into two conceptual categories: the Mine Facility Area (on-site) and the Riparian Area (off-site). The Mine Facility Area refers to the mine workings and the disturbed areas surrounding the mine, whereas the Riparian Area refers to surface water drainages adjacent to and downgradient of the mine site. Figure 3-1 identifies the potentially exposed populations within each of these areas which are briefly described below.

3.1.1 On-Site Exposed Populations

Recreational Visitor

The recreational visitor population represents individuals who may visit the site to engage in recreational activities over an extended period of time. Under current site conditions recreational activities are prohibited, although trespassing could occur. Because of the wide variety of recreational activities that people could be involved in at this site (hiking, biking, horseback riding, picnicking, dirt-bike ridding, snowmobiling, wading, etc.), two separate recreational scenarios are evaluated to serve as representative populations that could visit the site in the future: a hiker and an ATV rider.

Hiker

A hiker was selected to represent an involved in low-intensity (low soil disturbance) recreational activities and wading at the site. This individual is assumed to have exposure both as a young child (0-6 years) and as an adult (7-30 years). The hiker population may be exposed to surface soil (0-6"), sediment and surface water.

ATV Rider

An ATV rider was selected to represent an older child/adolescent or adult involved in high intensity (high soil disturbance) recreational activities such as dirt-bike riding or horseback riding. The ATV rider is assumed to only be exposed to site surface soil (0-6").

Construction Worker

The construction worker population represents individuals who may visit the site for a short period of time (e.g., 8 hours/day, for one year or less) and are involved in excavation activities such as installation or repair of utility lines, building foundations, highway expansion or repair, etc., where intensive contact with surface (0-6") and subsurface soil (soil up to 5 feet below ground surface) may occur.

Commercial Worker

The commercial worker population represents individuals who visit the site during a regular work day at a hypothetical future on-site commercial business. This type of worker is assumed to work primarily indoors, but may occasionally work outdoors where direct contact with exposed surface soil may occur. Commercial workers may also ingest groundwater as a drinking water source.

Resident

The resident population represents individuals living on the site now or in the future who may have direct contact with surface soil in their yards over a long period of time (around 30 years). Residents may also ingest groundwater as a drinking water source.

3.1.2 Off-Site (Riparian Area) Exposed Populations

Riparian Area receptors represent nearby residents that may visit drainages for recreational uses (such as fishing, wading, and hiking) and who may ingest groundwater as a drinking water source.

Recreational Fisherman

The recreational fisherman population represents individuals who may visit drainages nearby the site to fish where they may have direct contact with surface water and sediment while wading. The recreational fisherman is also assumed to consume locally caught fish.

Residential Children

Residential children living near the site may incidentally ingest surface water and sediment while playing in drainages. This population is assumed to be older children/adolescents (ages 6-12 years old).

Resident

The resident population represents individuals living near the site now or in the future who may ingest groundwater as a drinking water source over a long period of time (around 30 years).

3.2 Relative Importance of Exposure Pathways

Not all of the potential exposure routes are likely to be of equal concern. Exposure scenarios that are considered most likely to be of concern are shown in Figure 3-1 by boxes containing a solid circle. Greatest attention is focused on quantification of exposure from these pathways in order to determine if the pathway contributes significant risk. Pathways that are judged to contribute only minor exposures are shown by boxes with an "X". The following sections present a more detailed description of these pathways and an analysis of their relative importance for human exposure.

3.2.1 On-Site Receptors

Incidental Ingestion of Surface Soil

Even though few people intentionally ingest soil, commercial workers, construction workers, residents and recreational visitors who have direct contact with soil at the site might ingest small amounts that adhere to their hands during outdoor activities. In addition, soil can enter buildings (such as workplaces or residences) leading to contamination of indoor dust, which may also be ingested by hand to mouth activities. Construction workers could be exposed now or in the future as a consequence of excavation activities such as installation or repair of utility lines, building foundations, etc. Incidental ingestion of soil is often one of the most important routes of human exposure at a site, so ingestion of soil by workers, future residents and visitors is evaluated quantitatively in the risk assessment.

Incidental Ingestion of Sub-surface Soil

Construction workers may also be exposed to sub-surface soil during excavation activities and may incidentally ingest small amounts that adhere to their hands. Incidental ingestion of soil is often one of the most important routes of human exposure at a site, so ingestion of sub-surface soil by construction workers is evaluated quantitatively in the risk assessment.

Dermal Contact with Soil

Workers, residents and visitors may get soil on their skin during activities involving direct contact with soil. Even though information is limited on the rate and extent of dermal absorption of metals in soil across the skin, most scientists consider that this pathway is likely to be minor in comparison to the amount of exposure that occurs by soil and dust ingestion. This view is based on the following concepts: 1) most people do not have extensive and frequent direct contact with soil, 2) most metals tend to bind to soils, reducing the likelihood that they would dissociate from the soil and cross the skin, and 3) ionic species such as metals have a relatively low tendency to cross the skin even when contact does occur. Based on this, and recognizing that current methods and data are very limited for attempting to quantify dermal absorption of chemicals from soil, dermal contact with soil is not evaluated quantitatively in this risk assessment.

Inhalation of Airborne Soil Particulates

Whenever contaminated soil is exposed at the surface, particles of contaminated surface soil may become suspended in air by wind or mechanical disturbance, and humans in the area could inhale those particles. Screening level calculations (see Appendix B) suggest that exposure to particulates suspended by wind erosion is very small compared to oral exposure, and therefore this pathway is evaluated qualitatively rather than quantitatively. Screening level calculations suggest that particulates suspended by mechanical disturbances (such as ATVs or construction activities) might sometimes be of potential significance relative to oral exposure, so this pathway is evaluated quantitatively for construction workers and recreational visitors (ATV riders) in this risk assessment.

Exposure to Groundwater

At present, groundwater at the site is not used as a source of drinking water. However, hypothetical future use of groundwater at the site by commercial workers or residents is evaluated in the risk assessment in order to determine whether there would be any basis for health concern if the groundwater were ever used for drinking in the future.

Exposure to Surface Water and Sediment

The hiker recreational visitor is an individual who visits the site for the purposes of activities such as hiking, biking, picnicking. It is expected that on some occasion these visitors may also engage in activities at surface water locations, such as wading and splashing. Although it is not expected that recreational visitors intentionally drink water from on-site ponds or pits, these activities might lead to incidental ingestion of water or sediment, so these pathways were selected for quantitative evaluation. While dermal exposure to surface water and sediment may also occur, because the skin is relatively impermeable to metals, it is generally considered that dermal absorption of metals from water and sediment is likely to be relatively small compared to absorption from ingestion. Based on this, and recognizing that current methods and data are very limited for attempting to quantify dermal absorption, dermal contact with surface water and sediment are not evaluated quantitatively in this risk assessment.

Ingestion of Homegrown Produce Items

Residents may be indirectly exposed to chemicals by ingestion of garden vegetables or fruit grown in mining-impacted soil. Data are not available at the site on concentrations in food items and thus this exposure pathway cannot be evaluated quantitatively in this risk assessment. However, most metals have little tendency to accumulate in plant tissue, and exposure from ingestion of washed garden vegetables is likely to be a minor source of exposure compared with direct ingestion of soil. For example, a 1995 study at the Kennecott Mining site found no significant uptake of lead and arsenic into fruit or leafy and root vegetables (Life Systems, 1995). Data could be collected to confirm this, if in the future this pathway is judged to be a significant, complete exposure pathway (i.e., commercial production of fruit or vegetables at the site).

The potential for low risk is supported by studies conducted at other sites within Utah. For example a 1995 study at the Kennecott Mining site found no significant uptake of lead and arsenic into fruit or leafy and root vegetables. Furthermore, the study concluded that "no substantial degree of either cancer or non-cancer risk due to arsenic or lead is expected to result from the consumption of garden vegetables". Additionally, a 1996 study at the Murray Smelter site concluded that the exposure to arsenic from leafy and root vegetables, legumes, and garden fruits was two orders of magnitude less than that from soil and indoor dust (URS 2001). However, due to gaps in our understanding of metal uptake into garden vegetables specific to Eureka, a more reliable quantitative assessment pertaining to the magnitude of this overestimation can not be presented. Therefore, this pathway is not evaluated further in the risk assessment for this site.

3.2.2 Off-Site Receptors

Exposure to Groundwater

As mentioned above, there are two residential communities in the vicinity of the site, one of which utilizes private wells as their drinking water source. Thus, ingestion of groundwater is evaluated quantitatively in the risk assessment in order to determine whether there would be any basis for health concern.

Exposure to Surface Water and Sediment

A child resident living near a creek or drainage area may engage in activities such as wading and splashing. Although it is not expected that they intentionally drink water or ingest sediment from the waterway, these activities can lead to incidental ingestion of surface water and/or sediment, so these pathways were selected for quantitative evaluation. As noted above, methods for quantification of dermal exposure to surface water and sediment are limited, so these pathways were not evaluated quantitatively in this risk assessment.

Ingestion of Aquatic Food Items (Fish)

Recreational fisherman consuming locally caught fish may indirectly consume metals that are taken up from surface water or sediment into edible portions of fish. Thus, this pathway is evaluated quantitatively in the risk assessment.

3.3 Selection of Chemicals of Potential Concern

Chemicals of Potential Concern (COPCs) are chemicals which exist in the environment at concentration levels that might be of potential health concern to humans and which are or might be derived, at least in part, from site-related sources.

The procedure used to identify COPCs for the evaluation of risks to human receptors from soil, groundwater, surface water, sediment and fish tissue at this site is shown in Figure 3-2. Chemicals that are not likely to contribute significant risks to humans are eliminated, while chemicals that might be of potential concern are assigned to one of two groups: those that lack the data needed to perform a quantitative evaluation (these are addressed qualitatively), and those that have sufficient data to allow quantitative evaluation. It is important to note that this COPC selection procedure is intended to be conservative; that is, it is expected that some chemicals will be identified as COPCs that are actually of little or no concern, but that no chemicals of authentic concern will be overlooked.

Step 1: Eliminate chemicals for which no toxicity values are available

Risks from chemicals for which USEPA has not established toxicity values (see Section 4) cannot be evaluated quantitatively and so these chemicals were either evaluated semi-quantitatively (essential nutrients) or were assigned to the qualitative COPC category (all other chemicals).

If chemicals without established toxicity values are essential nutrients that are normal constituents of the human body and are required for good health (such as calcium, potassium, sodium), then estimated intake from site media were compared to daily intake values identified by the US Food and Drug Administration. If intake from the site did not substantially exceed the FDA daily values, these minerals were excluded from further consideration. If intake from the site substantially exceeded the FDA daily values, then a semi-quantitative assessment of the relative probability, nature and magnitude of adverse effects was conduced.

Step 2: Eliminate chemicals detected, but whose maximum value is below a level of concern

If a chemical is detected at least once, but the maximum detected concentration is well below a level of health concern, that chemical may be eliminated from further consideration. This screening step was performed using Risk-Based Concentration (RBC) values from USEPA Region 3 (USEPA 2005a). Target Risk levels were set to an HQ value of 0.1 and a cancer risk level of 1E-06. Because USEPA Region 3 does not have RBC values for either sediment or surface water, residential soil and tap water RBCs were used, respectively, to screen chemicals in these media.

Step 3: Eliminate chemicals with a detection frequency <5%

In accord with USEPA (1989), a chemical may be eliminated from the quantitative risk assessment if it is detected only infrequently (< 5%) in a site medium. Thus, in this risk assessment chemicals with a detection frequency ≥ 5% were retained and those with a detection frequency <5% were eliminated from further consideration.

Appendix C presents detailed results of the COPC selection process. Table 3-1 lists the COPCs identified for quantitative evaluation. COPCs identified for qualitative evaluation are presented in Table 3-2.

3.4 Quantification of Human Exposure

3.4.1 Non-Lead COPCs

Basic Approach

The amount of a chemical which is ingested, inhaled, or taken up across the skin is referred to as "intake" or "dose". For chemicals except lead, which is evaluated differently as discussed in Section 3.4.2, exposure is quantified using an equation of the following general form:

$$DI = C \cdot (IR / BW) \cdot (EF \cdot ED / AT)$$

where:

DI	=	Daily intake of chemical (mg of chemical per kg of body weight per day).
C	=	Concentration of the chemical in the contaminated environmental medium (soil, water) to which the person is exposed. The units are mg/L for water and mg/kg for soil.

IR = Intake rate of the contaminated environmental medium. The units are kg/day for soil and L/day for water.

BW = Body weight of the exposed person (kg).

EF = Exposure frequency (days/year). This describes how often a person is likely to be exposed to the contaminated medium over the course of a typical year.

ED = Exposure duration (years). This describes how long a person is likely to be exposed to the contaminated medium during their lifetime.

AT = Averaging time (days). This term specifies the length of time over which the average dose is calculated. Usually, two different averaging times are considered:

"Chronic" exposure includes averaging times on the scale of years (typically ranging from 7 years to 70 years). This exposure duration is used when assessing the non-cancer risks from chemicals of concern.

"Lifetime" exposure employs an averaging time of 70 years. This exposure interval is selected when evaluating cancer risks.

Note that the factors EF, ED, and AT combine to yield a factor between zero and one. Values near 1.0 indicate that exposure is nearly continuous over the specified averaging period, while values near zero indicate that exposure occurs only rarely.

For mathematical convenience, the general equation for calculating dose can be written as:

$$DI = C \cdot HIF$$

where:

HIF = Human Intake Factor. This term describes the average amount of an environmental medium contacted by the exposed person each day. The value of HIF is typically given by:

$$HIF = (IR / BW) \cdot (EF \cdot ED / AT)$$

The units of HIF are kg/kg-day for soil and L/kg-day for water.

Because one or more exposure parameters (e.g., intake rates, body weight, exposure frequency) may change as a function of age, exposure calculations are often performed separately for children and adults. In the case of residents, because the same individual may be exposed beginning as a child and extending into adulthood, exposure is calculated as the time-weighted average (TWA) exposure:

$$TWA\ DI = C \cdot [(IRc / BWc) \cdot (EFc \cdot EDc / AT) + [(IRa / BWa) \cdot (EFa \cdot EDa / AT)]$$

where the subscripts "c" and "a" refer to child and adult, respectively.

Human Exposure Parameters

For every exposure pathway of potential concern, it is expected that there will be differences between different individuals in the level of exposure at a specific location due to differences in intake rates, body weights, exposure frequencies, and exposure durations. Thus, there is normally a wide range of average daily intakes between different members of an exposed population. Because of this, all daily intake calculations must specify what part of the range of doses is being estimated. Typically, attention is focused on intakes that are "average" or are otherwise near the central portion of the range, and on intakes that are near the upper end of the range (e.g., the 95th percentile). These two exposure estimates are referred to as Central Tendency Exposure (CTE) and Reasonable Maximum Exposure (RME), respectively.

The USEPA has collected a wide variety of data and has performed a number of studies to help establish default values for most residential and worker exposure parameters, and some recreational exposure parameters. The chief sources of these standard default values are the following documents:

1. Risk Assessment Guidance for Superfund (RAGS). Volume I. Human Health Evaluation Manual (Part A). USEPA 1989.

2. Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors." USEPA 1991a.

3. Superfund's Standard Default Exposure Factors for the Central Tendency and Reasonable Maximum Exposure. Draft. USEPA 1993.

4. Exposure Factors Handbook. USEPA 1997b.

5. Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. USEPA 2002a.

Parameters from these guidance documents were used whenever possible. However, USEPA has not established default exposure parameters for some of the exposure pathways of potential concern at this site, so some parameters were selected by use of professional judgment.

Due to the lack of site specific data on the frequency of recreational use of the Gilt Edge Mine Site, an open space usage survey in Jefferson County, Colorado (Jefferson County

Open Space Department, 1996) were used to estimate the exposure frequency (EF) for recreational visitors at the Gilt Edge Site. During 1996, 779 individuals were interviewed and asked to quantify the number of times per year they visited Open Space Parks in Jefferson County. The arithmetic mean (39 visits/year) and 90th percentile (100 visits/year) of the total number of visits per year were calculated from the survey results and are used as the CTE and RME exposure frequency assumptions, respectively, for the Gilt Edge Mine Site. The CTE and RME exposure frequencies were multiplied by an additional parameter, fraction of exposure at the site (FS), to adjust for the potential use of additional open spaces, other than the Gilt Edge Mine Site, for recreation. In the absence of any site-specific data, the CTE and RME values for the FS parameter were set to 0.5 and 1.0, respectively, based on professional judgment. Theses values are thought to be appropriate for both CTE and RME scenarios by assuming that 50% and 100% of all recreational visits, respectively, occur at the Gilt Edge Mine Site. Thus, 19.5 visits/year (CTE) and 100 visits per year (RME) are used as the exposure frequency assumptions at the site.

Additionally, no site-specific data on recreation exposure frequency or duration of wading activities are available, so values of 2 (CTE) to 10 (RME) days/year, and 0.5 (CTE) to 1.5 (RME) hours/day are assumed. The exposure time is based on the FE Warren site (SAF, 2000), where estimated time spent in surface waters were evaluated.

The CTE and RME exposure parameters for all receptors evaluated in the risk assessment are presented in Tables 3-3 through 3-10. Table 3-11 presents a summary of HIF values by receptor and media.

3.4.2 Evaluating Human Exposure to Lead

Overview

As noted earlier, risks from lead are evaluated using a somewhat different approach than for most other chemicals. First, because lead is widespread in the environment, exposure can occur by many different pathways. Thus, lead risks are usually based on consideration of total exposure (all pathways) rather than just to site-related exposures. Second, because studies of lead exposures and resultant health effects in humans have traditionally been described in terms of blood lead level, lead exposures and risks are typically assessed using an uptake-biokinetic model rather than calculating an estimated dose. Therefore, calculating the level of exposure and risk from lead in soil also requires assumptions about the level of lead in other media, and also requires use of pharmacokinetic parameters and assumptions that are not needed in traditional methods.

Health-Based Goal for Lead

Excess exposure to lead can result in a wide variety of adverse effects in humans. Chronic low-level exposure is usually of greater concern for young children than older children or adults. There are several reasons for this focus on young children, including the following: 1) young children typically have higher exposures to lead-contaminated media per unit body weight than adults, 2) young children typically have higher lead absorption rates than adults, and 3) young children are more susceptible to effects of lead than are adults.

It is currently difficult to identify what degree of lead exposure, if any, can be considered safe for infants and children. As discussed above, some studies report subtle signs of lead-induced effects in children and perhaps adults beginning at around 10 µg/dL or even lower, with population effects becoming clearer and more definite in the range of 30-40 µg/dL. Of special concern are the claims by some researchers that effects of lead on neurobehavioral performance, heme synthesis, and fetal development may not have a threshold value, and that the effects are long-lasting (USEPA 1986). On the other hand, some researchers and clinicians believe the effects that occur in children at low blood lead levels are so minor that they need not be cause for concern (USEPA 1986).

After a thorough review of all the data, the USEPA identified 10 µg/dL as the concentration level at which effects begin to occur that warrant avoidance, and has set as a goal that there should be no more than a 5% chance that a child will have a blood lead value above 10 µg/dL (USEPA 1991c and 1994a). Likewise, the Centers for Disease Control (CDC) has established a guideline of 10 µg/dL in preschool children which is believed to prevent or minimize lead-associated cognitive deficits (CDC 1991). By analogy, a value of 10 µg/dL is also generally applied to a fetus in utero. For convenience, the probability of a blood lead value exceeding 10 µg/dL is referred to as P10.

Lead Exposure Models and Exposure Parameters for Lead

Because the effects of lead exposure are evaluated differently for young children than they are for adults, two separate modeling approaches were used to evaluate risks from exposure to lead at the site: one specific to children (residents and hikers) and one appropriate for older individuals (ATV riders, workers, recreational fisherman, off-site child resident). These approaches are described in further detail below.

Adults

The approach described by Bowers et al. (1994) has been identified by USEPA's Technical Workgroup for Lead (USEPA 1996) as a reasonable interim methodology for assessing risks to adults from exposure to lead and for establishing risk-based concentration goals that will protect older children and adults from lead. For this reason, this method was used for estimating exposure to current or future commercial workers, to lead in soil. When adults are exposed, the sub-population of chief concern is pregnant women and women of child-bearing age, since the blood lead level of a fetus is nearly equal to the blood lead level of the mother (Goyer 1990).

The Bowers model predicts the blood lead level in an adult with a site-related lead exposure by summing the "baseline" blood lead level (PbB0) (that which would occur in the absence of any site-related exposures) with the increment in blood lead that is expected as a result of increased exposure due to contact with a lead-contaminated site medium. The latter is estimated by multiplying the average daily absorbed dose of lead from site-related exposure by a "biokinetic slope factor" (BKSF). Thus, the basic equation for exposure to lead in soil is:

$$PbB = PbB0 + BKSF \cdot [PbS \cdot IRs \cdot AFs \cdot EFs/365]$$

where:

PbB	=	Geometric mean blood lead concentration (μg/dL) in women of child-bearing age) that are exposed at the site
PbB0	=	"Background" geometric mean blood lead concentration (μg/dL) in women of child-bearing age in the absence of exposures to the site
BKSF	=	Biokinetic slope factor (μg/dL blood lead increase per μg/day lead absorbed)
PbS	=	Soil lead concentration (μg/g)
IRs	=	Intake rate of soil (g/day)
AFs	=	Absolute gastrointestinal absorption fraction for lead in soil (dimensionless). The value of AFs is given by: $AFs = AF(food) \cdot RBA(soil)$
EFs	=	Exposure frequency for contact with site soils (days per year)

Once the geometric mean blood lead value is calculated, the full distribution of likely blood lead values in the population of exposed people can then be estimated by assuming the distribution is lognormal with a specified individual geometric standard deviation (GSDi). The 95th percentile of the predicted distribution is given by the following equation (Aitchison and Brown 1957):

$$95th = GM \cdot GSD_i^{1.645}$$

Input values selected for each of these parameters are summarized in Table 3-12. As seen, all of the exposure values for contact with site media are the same as the CTE exposure parameters assumed for other chemicals, and most of the biokinetic parameters are the defaults recommended by USEPA (1996). The baseline blood lead value and the individual geometric mean value are both based on analysis by AGEISS (1996) of blood lead data originally collected by Bornschein in 1994 at the Bingham Creek site, a mining site near Salt Lake City. In this study, blood lead data were obtained for 127 pregnant or nursing women. The baseline blood lead value of 1.7 ug/dL is the geometric mean blood lead concentration for these women, and the GSD_i value of 1.5 was derived from these data using the sliding box model approach recommended by USEPA (1994a).

Children

For lead exposures, the sub-population of chief concern is young children. This is because young children 1) tend to have higher exposures to lead in soil, dust, and paint, 2) tend to have a higher absorption fraction for ingested lead, and 3) are more sensitive to the toxic effects of lead than are older children or adults.

The USEPA has developed an Integrated Exposure Uptake Biokinetic (IEUBK) model for predicting the likely range of blood lead levels in a population of young children (age 0-6 years) exposed to a specified set of environmental lead levels (USEPA 1994b). This model requires as input data on the levels of lead in soil, dust, water, air, and diet at a particular location, and on the amount of these media ingested or inhaled by a child living at that location. All of these inputs to the IEUBK model are central tendency point estimates. These point estimates are used to calculate an estimate of the central tendency (the geometric mean) of the distribution of blood lead values that might occur in a population of children exposed to the specified conditions. Assuming the distribution is lognormal, and given (as input) an estimate of the variability between different children (this is specified by the geometric standard deviation or GSD), the model calculates the expected distribution of blood lead values, and estimates the probability that any random child might have a blood lead value over 10 μg/dL.

For this site, risks to child hikers from ingestion of soil, surface water and sediment and risks to off-site child residents from ingestion of groundwater were evaluated by running two sets of IEUBK model calculations. The first evaluated baseline risks. The second was used to address the total risk observed from baseline plus exposure to site-impacted media. By comparing the two simulations and resulting predictions of blood lead concentrations, the excess risk attributable to site-impacted media (soil, sediment, surface water and off-site groundwater) were identified.

The default and site-specific inputs to the IEUBK model are presented in Table 3-13. The GSD recommended as the default for the IEUBK model is 1.6 (USEPA 1994). However, several blood lead studies that have been performed in mining sites in the Rocky Mountain West have yielded GSD estimates of about 1.4 (Griffin et al., 1999). Therefore, a GSD value of 1.4 was utilized in this assessment.

Where indoor dust data were not collected, USEPA generally assumes that the concentration of a chemical contaminant in indoor dust is 70-100% of the concentration in outdoor soil. However, studies that have been performed at a number of mining/smelting sites in the Rocky Mountain West have indicated that this assumption is often somewhat over-conservative (USEPA 2001c and 2002d; Weston 1995 and 1997). These data are summarized in the table below.

Site	Location	Soil-Dust Relationship for Lead
Bingham Creek	Utah	0.43
California Gulch	Colorado	0.25
Eureka Mills	Utah	0.15
Murray Smelter	Utah	0.19
Vasquez Boulevard and Interstate 70	Colorado	0.34

As seen, most estimates of indoor dust are approximately 20%-30% of outdoor soil (slope values of 0.2 – 0.3) or less. In order to be conservative, the highest soil-dust relationship (Bingham Creek) was used to estimate indoor dust concentrations at the Gilt Edge Site.

Baseline risks were calculated using the exposure values presented in Table 3-13, with the exception of surface soil. The value entered for soil is the concentration that results in a geometric mean blood lead level of 2.7 ug/dL. This blood lead level is the mean blood lead for U.S. children ages 1-5 (Pirkle et al. 1998). The soil concentration associated with a 2.7 ug/dL blood lead level was determined by running the IEUBK model in batch mode, using the exposure values in Table 3-13 and a range of soil concentrations (see Appendix F for these results). The soil concentration that yielded a 2.7 ug/dL geometric mean blood lead concentration was 231 mg/kg .

To evaluate the incremental risk to a hiker from exposure to lead in on-site surface water, sediment and surface soil, the total absorbed dose of lead (ug/day) from on-site media was calculated and entered into the model's "alternate" menu (see Appendix F for dose calculations). The general equation used to calculate the total absorbed lead dose is as follows:

$$\text{Total absorbed dose (ug/day)} = C \bullet (IR*EF)/365 \bullet AF$$

where:

C	=	Average lead concentration (mg/kg or ug/L)
IR	=	Ingestion rate (mg/day or L/day)
EF	=	Exposure frequency (days/year)
AF	=	Absolute gastrointestinal absorption fraction for lead (dimensionless).

The default model absorption fractions listed in Table 3-13 were used. The soil absorption fraction was used for sediment

In the incremental risk IEUBK model calculations, a value of 100 was entered as the total percent assessable for the alternate lead intake, because media specific assumptions about bioavailability were included in the total absorbed dose calculations.

3.5 Selection of Exposure Points

An exposure point (also referred to as an exposure unit or exposure area) is an area where a receptor (worker, visitor, or resident) may be exposed to one or more environmental media. Selection of the bounds of an exposure point is based mainly on a consideration of the likely activity patterns of the exposed receptors; that is, an exposure point is an area within which a receptor is likely to spend most of their time and to move about more or less at random.

Soil

The Gilt Edge Mine site was divided up into 5 exposure units, based on current site features (see Figure 3-3, and Table 3-14). These large areas may be representative of the area which a recreational visitor (ATV rider, hiker) may use when visiting the site. Because site reclamation activities may be based on current site features (pits, ponds), these large exposure areas may be appropriate for future commercial and/or residential use, as remedial actions may be taken across large sub-areas of the site.

Groundwater

Because the concentrations of metals in groundwater vary from well to well, exposure and risk from metals in groundwater will vary depending on the precise location where a hypothetical future drinking water well might be installed. Therefore, risks from groundwater were evaluated on a well-by-well basis (see Figure 3-4).

Surface Water, Sediment and Fish Tissue

Because the concentrations of metals in surface water and sediment may vary between surface water bodies and can be influenced by confluences with other tributaries, exposure units for surface water, sediment and fish tissue were based on a surface water body (i.e., pit lake, pond) or reach-by-reach basis (see Figures 3-5 through 3-7 and Table 3-15). These smaller stream segments may also be representative of the area that a recreational user may cover while wading or fishing at the site.

3.6 Exposure Point Concentrations

Because of the assumption of random exposure over an exposure area, risk from a chemical is related to the arithmetic mean concentration of that chemical averaged over the entire exposure area. Since the true arithmetic mean concentration cannot be calculated with certainty from a limited number of measurements, the USEPA recommends that the upper 95th percentile confidence limit (UCL) of the arithmetic mean at each exposure point be used when calculating exposure and risk at that location (USEPA 1992a). If the 95% UCL exceeds the highest detected concentration, the highest detected value is used instead (USEPA 1989). The approach that is most appropriate for computing the 95% UCL of a data set depends on a number of factors, including the number of data points available, the shape of the distribution of the values, and the degree of censoring (USEPA 2002a). At this site, when 10 or more samples were available for a chemical, the EPC was calculated using EPA's ProUCL Software. If less than 10 samples were available, the maximum concentration was used as the EPC. Samples that are below the detection limit were evaluated using a value equal to one-half the detection limit.

Because the valence state of chromium in site media is not know, the following assumptions and adjustments were made to chromium EPCs, based on the most likely form for each media (ATSDR 2000; USEPA 1998a and 1998b):

Media	Percent Chromium	
	Chromium III	Chromium VI
Soil	90%	10%
Sediment	90%	10%
Surface Water	90%	10%
Groundwater	0%	100%

Information was not available on the form of chromium in fish tissue, thus it was conservatively assumed that all chromium was present as chromium VI.

Appendix D presents tables that summarize the EPCs for each COPC in each medium of potential concern at the site.

Approach for COPCs in Air

Because no data were collected on soil particulate levels in air at the Gilt Edge Mine site generated during mechanical disturbances (construction activities, ATV use), the concentration was estimated using a simple mathematical model recommended by USEPA, as follows:

$$C(air) = C(soil) \cdot PEF$$

where:

C(air) = concentration of contaminant in air (mg/m^3)
C(soil) = concentration of contaminant in soil (mg/kg)
PEF = particulate emission factor (kg of soil per m^3 of air)

Appendix E presents the derivation of the two PEF values used in the risk assessment:

$PEF_{construction} = 2.86E\text{-}08\ kg/m^3$
$PEF_{atv} = 1.18E\text{-}06\ kg/m^3$

4.0 TOXICITY ASSESSMENT

The basic objective of a toxicity assessment is to identify what adverse health effects a chemical causes, and how the appearance of these adverse effects depends on exposure level. In addition, the toxic effects of a chemical frequently depend on the route of exposure (oral, inhalation, dermal) and the duration of exposure (subchronic, chronic, or lifetime). Thus, a full description of the toxic effects of a chemical includes a listing of what adverse health effects the chemical may cause, and how the occurrence of these effects depends upon dose, route, and duration of exposure.

4.1 Basic Methods

The toxicity assessment process is usually divided into two parts: the first characterizes and quantifies the non-cancer effects of the chemical, while the second addresses the cancer effects of the chemical. This two-part approach is employed because there are typically major differences in the time-course of action and the shape of the dose-response curve for cancer and non-cancer effects.

4.2 Non-Cancer Effects

Essentially all chemicals can cause adverse health effects if given at a high enough dose. However, when the dose is sufficiently low, typically no adverse effect is observed. Thus, in characterizing the non-cancer effects of a chemical, the key parameter is the threshold dose at which an adverse effect first becomes evident. Doses below the threshold are considered to be safe, while doses above the threshold are likely to cause an effect.

The threshold dose is typically estimated from toxicological data (derived from studies of humans and/or animals) by finding the highest dose that does not produce an observable adverse effect, and the lowest dose which does produce an effect. These are referred to as the "No-observed-adverse-effect-level" (NOAEL) and the "Lowest-observed-adverse-effect-level" (LOAEL), respectively. The threshold is presumed to lie in the interval between the NOAEL and the LOAEL. However, in order to be conservative (protective), non-cancer risk evaluations are not based directly on the threshold exposure level, but on a value referred to as the Reference Dose (RfD). The RfD is an estimate (with uncertainty spanning perhaps an order of magnitude) of a daily exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious effects during a lifetime.

The RfD is derived from the NOAEL, LOAEL or benchmark dose by dividing by an "uncertainty factor" that reflects the limitations of the data used. If the data are from studies in humans, and if the observations are considered to be very reliable, the uncertainty factor may be as small as 1.0. However, the uncertainty factor is normally at least 10, and can be much higher if the data are limited. The effect of dividing the NOAEL or the LOAEL by an uncertainty factor is to ensure that the RfD is not higher than the threshold level for adverse effects. Thus, there is always a "margin of safety" built into an RfD, and doses equal to or less than the RfD are nearly certain to be without any risk of adverse effect. Doses higher than the RfD may carry some risk, but because of the margin of safety, a dose above the RfD does not mean that an effect will necessarily occur.

4.3 Cancer Effects

For cancer effects, the toxicity assessment process has two components. The first is a qualitative evaluation of the weight of evidence (WOE) that the chemical does or does not cause cancer in humans. Typically, this evaluation is performed by the USEPA, using the system summarized below:

WOE Group	Meaning	Description
A	Known human carcinogen	Sufficient evidence of cancer in humans.
B1	Probable human carcinogen	Suggestive evidence of cancer incidence in humans.
B2	Probable human carcinogen	Sufficient evidence of cancer in animals, but lack of data or insufficient data in humans.
C	Possible human carcinogen	Suggestive evidence of carcinogenicity in animals.
D	Cannot be evaluated	No evidence or inadequate evidence of cancer in animals or humans.

For chemicals which are classified in Group A, B1, B2, or C, the second part of the toxicity assessment is to describe the carcinogenic potency of the chemical. This is done by quantifying how the number of cancers observed in exposed animals or humans increases as the dose increases. Typically, it is assumed that the dose response curve for cancer has no threshold, arising from the origin and increasing linearly until high doses are reached. Thus, the most convenient descriptor of cancer potency is the slope of the dose-response curve at low doses (where the slope is still linear). This is referred to as the Slope Factor (SF), which has dimensions of risk of cancer per unit dose.

Estimating the cancer Slope Factor is often complicated by the fact that observable increases in cancer incidence usually occur only at relatively high doses, frequently in the part of the dose-response curve that is no longer linear. Thus, it is necessary to use mathematical models to extrapolate from the observed high dose data to the desired (but unmeasurable) slope at low dose. In order to account for the uncertainty in this extrapolation process, USEPA typically chooses to employ the upper 95th confidence limit of the slope as the Slope Factor. That is, there is a 95 percent probability that the true cancer potency is lower than the value chosen for the Slope Factor. This approach ensures that there is a margin of safety in cancer as well as non-cancer risk estimates.

4.4 Human Toxicity Values

Toxicity values (RfD and SF values) are often estimated by a variety of different groups or agencies. USEPA (2003d) describes the recommended hierarchy for selecting toxicity values for use in human health risk assessment at Superfund sites. The first preference is for USEPA consensus values as listed in the Integrated Risk Information System (IRIS), an electronic database containing human health assessments for various chemicals (available online at http://www.epa.gov/iris/). If values are not available from IRIS, the next preference is to seek Provisional Peer Reviewed Toxicity Values for Superfund (PPRTVs) developed by EPA's Superfund Health Risk Technical Support Center (STSC). If PPRTVs are not available, toxicity values may be obtained from other sources, such as the Agency for Toxic Substances and Disease Registry (ATSDR) Minimal Risk Levels (MRLs) (available online at http://www.atsdr.cdc.gov/mrls.html), California EPA's Toxicity Criteria Database (available online at http://www.oehha.ca.gov/risk/ChemicalDB/index.asp), and USEPA's Health Effects Assessment Summary Tables (HEAST) (USEPA 1997c). Most of these values are also compiled in the Risk-Based Concentration tables developed and maintained by USEPA Region III (USEPA 2004c).

Table 4-1 summarizes the toxicity values used for evaluation of human health risks from quantitative COPCs at this site. Values were selected in accordance with USEPA (2003d). Points to note regarding the data in this table are listed below:

- Two oral RfD values are available for cadmium, depending on exposure medium (water, food). The value for food is assumed to apply to soil.
- The RfD for manganese in soil and water (0.023 mg/kg-day) is based on the oral RfD of 1.4E-01 mg/kg-day in the diet. In accord with recommendations in IRIS, this value is modified by dividing by a Modifying Factor of 3 for application to exposures from soil or water.

4.5 Adjustments for Relative Bioavailability

Accurate assessment of human exposure to chemicals in the environment requires knowledge of the amount of metal absorbed into the organism following contact with a contaminated medium. This information is especially important for environmental media such as soil or mine wastes, because metals in these media may exist, at least in part, in a variety of poorly water soluble minerals, and may also exist inside particles of inert matrix such as rock or slag. These chemical and physical properties may tend to influence (usually decrease) the absorption (bioavailability) of the metals.

If data are available on the availability of a chemical in a site medium (e.g., soil) compared to the bioavailability of that chemical in whatever medium was used to develop a human toxicity value, the ratio of the bioavailability values can be used to adjust the toxicity values to yield an improved estimate of risk at the site.

The ratio of the absorption fraction for a chemical in site medium compared to the medium used in the key toxicity studies is referred to as the Relative Bioavailability (RBA). If reliable estimates of RBA are available for chemicals of potential concern in site media, these can be used to adjust the default RfD and SF values as follows:

$$RfD_{adj} = RfDdefault / RBA$$
$$SF_{adj} = SFdefault \cdot RBA$$

4.5.1 Site-Specific Estimates of RBA for Arsenic in Soil

In general, the most reliable means for obtaining absorption data on a metal that is present in a particular soil or mine waste is to study the rate and extent of absorption of the metal when the material is fed to an appropriate test animal. However, such in vivo studies are slow and costly, and no such in vivo test results exist for soils from this site.

However, in vivo testing of arsenic in soil and mine waste has been conducted at a variety of other sites in the Rocky Mountain West (USEPA 2005b). In 26 test materials, the RBA of arsenic ranged from 8 - 61% (RBA of 0.08 to 0.61) with a mean of 34% (0.34). Of the 26 test materials investigated, only 5 exceeded 50%, and 1 exceeded 60%. Based on this, an RBA of 0.5 is considered a generally conservative default value for arsenic in soil.

4.5.2 Site-Specific Estimates of RBA for Other Chemicals in all Media

No site-specific data were available on the relative bioavailability of any COPCs in soil or any other environmental media. In the absence of site-specific data, the RBA for all chemicals in all media was assumed to be 1.0 (USEPA 1989), with one exception. For human exposure to lead, the USEPA (1994b and 2003c) recommended default RBA for lead in soil of 0.6 was assumed.

5.0 RISK CHARACTERIZATION

5.1 Basic Approach

5.1.1 Non-Cancer

Non-Lead COPCs

For most chemicals, the potential for non-cancer effects is evaluated by comparing the estimated daily intake of the chemical over a specific time period with the RfD for that chemical derived for a similar exposed period. This comparison results in a non-cancer Hazard Quotient (HQ), as follows (USEPA 1989):

$$HQ = DI / RfD$$

where:

HQ	=	Hazard Quotient
DI	=	Daily Intake (mg/kg-day)
RfD	=	Reference Dose (mg/kg-day)

If the HQ for a chemical is equal to or less than one (1E+00), it is believed that there is no appreciable risk that non-cancer health effects will occur. If an HQ exceeds 1E+00, there is some possibility that non-cancer effects may occur, although an HQ above 1E+00 does not indicate an effect will definitely occur. This is because of the margin of safety inherent in the derivation of all RfD values (see Section 4). However, the larger the HQ value, the more likely it is that an adverse effect may occur.

If an individual is exposed to more than one chemical, a screening-level estimate of the total non-cancer risk is derived simply by summing the HQ values for that individual. This total is referred to as the Hazard Index (HI). If the HI value is less than 1E+00, non-cancer risks are not expected from any chemical, alone or in combination with others. If the screening level HI exceeds 1E+00, it may be appropriate to perform a follow-on evaluation in which HQ values are added only if they affect the same target tissue or organ system (e.g., the liver). This is because chemicals which do not cause toxicity in the same tissues are not likely to cause additive effects.

Lead

As described in Section 3.4.2, non-cancer risks from exposure to lead are evaluated using a somewhat different approach. In brief, mathematical models are used to estimate the distribution of blood lead values in a population of people exposed to lead under a specified set of conditions. Health risks are judged to be acceptable if there is no more than a 5% chance that an exposed individual (a child or a woman of child-bearing age) will have a blood lead level that exceeds 10 ug/dL. For convenience, this probability is referred to as P10.

5.1.2 Cancer

The excess risk of cancer from exposure to a chemical is described in terms of the probability that an exposed individual will develop cancer because of that exposure by age 70. For each chemical of concern, this value is calculated from the daily intake of the chemical from the site, averaged over a lifetime (DI_L), and the slope factor (SF) for the chemical, as follows (USEPA 1989):

$$\text{Excess Cancer Risk} = 1 \cdot \exp(-DI_L \cdot SF)$$

In most cases (except when the product of $DI_L \cdot SF$ is larger than about 0.01), this equation may be accurately approximated by the following:

$$\text{Excess Cancer Risk} = DI_L \cdot SF$$

Excess cancer risks are summed across all chemicals of concern and all exposure pathways that contribute to exposure of an individual in a given population.

The level of total cancer risk that is of concern is a matter of personal, community, and regulatory judgment. In general, the USEPA considers excess cancer risks that are below about 1E-06 to be so small as to be negligible, and risks above 1E-04 to be sufficiently large that some sort of remediation is desirable. Excess cancer risks that range between 1E-04 and 1E-06 are generally considered to be acceptable (USEPA 1991b), although this is evaluated on a case by case basis, and USEPA may determine that risks lower than 1E-04 are not sufficiently protective and warrant remedial action.

5.2 Risks to Receptors at On-Site Locations

Detailed calculations of risks to on-site receptors, stratified by chemical, medium and exposure unit, are presented in Appendix F. Summaries of the risk results are presented below.

5.2.1 Risks from Ingestion and Inhalation of On-Site Soils

Table 5-1 summarizes risks to current or hypothetical future on-site receptors from incidental ingestion and (where relevant) inhalation of on-site soils. As seen:

- For hikers, risks are below a level of concern to CTE individuals in all exposure areas, but may be above a level of concern to an RME individual for non-cancer effects in three exposure areas (AH&P, LP, PCA). Non-cancer risks are due primarily to thallium, with additional contributions from arsenic at one location (PCA).

- For ATV riders, risks are below a level of concern to CTE individuals in all exposure areas, but may be above a level of concern to an RME individual for non-cancer effects in all exposure areas and cancer effects in one exposure area (LP). Non-cancer risks at all locations are primarily due to the inhalation of manganese. Ingestion of thallium also contributes to the non-cancer risks at two areas (AH&P and LP). Cancer risks are due to ingestion of arsenic, with additional contributions from the inhalation pathway.
- For construction workers, risks are above a level a level of concern for non-cancer effects at all exposure areas, while cancer risks are not of concern at any location. The non-cancer risks are due almost entirely to ingestion exposure, and risks from inhalation exposure are minimal. Non-cancer risks are primarily due to thallium with additional contributions from arsenic at two areas (HLP and LP).
- For hypothetical future on-site commercial workers, risks are above a level of concern for non-cancer effects at two exposure areas (HLP, LP). Non-cancer risks at these locations are due to thallium.
- For hypothetical future on-site residents, non-cancer effects would be of concern to CTE and/or RME in individuals in all locations except for RGWRD, and cancer effects would be of concern to RME individuals in all locations except for RGWRD. Non-cancer risks are primarily due to thallium with additional contributions from arsenic at two areas (HLP and LP). Cancer risks are entirely due to arsenic. Risks from lead would also be of concern (P10 > 5%) to children in one area (LP).

These results indicate that levels of thallium, arsenic and manganese in on-site soils may pose a risk to current on-site visitors (hikers, ATV riders), and would also be of potential concern for workers and residents under hypothetical future land use scenarios.

In interpreting these risks, it is important to note that concentrations of manganese and thallium measured in on-site soils are within published background ranges for the State of South Dakota (Shacklette and Boerngen 1984). Thus, risks attributed to these chemicals may not be site-related.

5.2.2 Risks from Ingestion of On-Site Surface Waters and Sediments

Table 5-2 summarizes risks to current or future hikers at the site who may have incidental ingestion of on-site surface waters or sediments. As seen:

- For total metals in surface water (Panel A), risks are below a level of concern for both cancer and non-cancer effects in a majority of locations, but there are seven locations (DMPL, PDD, PDE, RPD, RRB, SC1 and SPL) where risks may be of both non-cancer and cancer concern to an RME individual. Non-cancer risks are due mainly to arsenic, with additional contributions from cadmium, copper, iron, manganese, and occasionally aluminum. Cancer risks are due entirely to arsenic. Risks from lead are not of concern at any location.
- For exposure to sediments (Panel B), risks are below a level of concern in most locations, although cancer risks may exceed 1E-04 at two locations (DMPL, SPL).

for an RME individual. These risks are due to arsenic. Risks from lead are not of concern at any location.

These results indicate that risks from surface water and sediment are likely to be below a level of concern for most on-site hikers, but that individuals with RME exposures may exceed EPA's risk based goals if exposure were to occur repeatedly in some specific locations.

5.2.3 Risks from Ingestion of On-Site groundwater

Table 5-3 summarizes risks to hypothetical future on-site residents from ingestion of groundwater from various on-site wells. As seen:

- Non-cancer risks are above a level of concern at all locations, both for dissolved metals (top panel) and total metals (lower panel). These non-cancer risks are contributed by a wide variety of metals, including arsenic, cadmium, chromium, copper, iron, antimony, zinc, manganese, aluminum, and thallium. Risks from lead exceed EPA's health based goal (P10 ≤ 5%) at several locations.
- Cancer risks exceed a level of 1E-04 at numerous wells, especially for an RME individual. This risk is due to arsenic.

Generally similar results are seen for hypothetical future on-site commercial workers (Table 5-4), although risk levels are somewhat lower than for residents because of the assumed lower water intake by workers compared to residents.

These results indicate that ingestion of groundwater by residents or workers would pose unacceptable risks from the presence of multiple metals in essentially all locations.

5.3 Risks to Receptors Along Off-Site Surface Water Drainages

Detailed calculations of risks to receptors along off-site drainages, stratified by chemical, medium and exposure area, are presented in Appendix F. Summaries of the risk results are presented below.

5.3.1 Risks from Incidental Ingestion of Surface Water and Sediment

Table 5-5 summarizes risks to current or hypothetical future children who may live along creeks and other channels draining the site, and who may have incidental ingestion of surface water or sediment during play. As seen:

- Non-cancer and cancer risks from ingestion of total metals in surface water are below a level of concern for both CTE and RME individuals at all locations.
- Risks from incidental ingestion of sediment are below a level of non-cancer and cancer concern at all locations
- Risks from lead are below a level of concern from both surface water and sediment at all locations.

Risks to recreational fisherman (Table 5-6) are generally similar to those observed for a residential child (Table 5-5), with non-cancer and cancer risks from surface water and sediment that are below a level of concern at all locations.

These results indicate that there is little risk to children or other recreational visitors who may have contact with surface water of sediment along off-site creeks and drainages.

5.3.2 Risks from Ingestion of Fish

Table 5-7 summarizes estimated risks to a fisherman who catches and eats fish from creeks and streams draining the site. As seen, non-cancer risks are below a level of concern and cancer risks are below 2E-05 at all locations. As discussed in Section 3.3, lead was not identified as a COPC in fish tissue. These results indicate that ingestion of fish from local creeks and drainages is not likely to be of concern.

5.3.3 Risks from Ingestion of Groundwater

Table 5-8 summarizes risks to current or hypothetical future residents from ingestion of groundwater from off-site wells located mainly along creeks and channels that drain the site. Results are presented both for dissolved metals (Panel A) and for total metals (Panel B). As seen:

- Non-cancer risks are above a level of concern for many well locations, both for a CTE and RME receptor, for both dissolved and total metals. This risk is attributable to numerous chemicals, including arsenic, cadmium copper, iron, manganese, antimony, and thallium, with the relative contribution varying from well to well.
- Cancer risks for both dissolved and total metals exceed 1E-04 for RME receptors at a number of wells, with all values exceeding 1E-05. This risk is due to arsenic in the groundwater.
- Lead risks are not above a level of concern based on dissolved or total metals, with the exception of one well (BED-19). The concentration of lead in the total fraction at this location exceeds EPA's health based goal ($P10 \leq 5\%$). This suggests that the water contains suspended particulate matter, which would be of potential concern if not filtered or allowed to settle before ingestion.

These results indicate that ingestion of groundwater from wells near the site is likely to pose unacceptable levels of non-cancer and cancer risk in most locations, due to the presence of numerous dissolved and suspended metals.

5.4 Combined Risks from All Exposure Pathways

5.4.1 Basic Approach

Some receptors may be exposed to contaminants by more than one exposure pathway (see Figure 3-1). Thus, the total risk from exposure at the site is the sum of the risks from all exposure pathways:

$$\text{Risk}_{(\text{total})} = \text{Risk}_{(\text{exposure pathway 1})} + \text{Risk}_{(\text{exposure pathway 2})} + \text{Risk}_{(\text{exposure pathway 3})} \ldots$$

Because the risk for any pathway is a distribution, care must be taken in the summation process. In the case of the risk to an individual who has average (CTE) exposure to all pathways, the total risk is simply the sum of pathway specific risks:

$$\text{CTE Risk}_{(\text{total})} = \text{CTE Risk}_{(\text{exposure pathway 1})} + \text{CTE Risk}_{(\text{exposure pathway 2})} \ldots .$$

In the case of an individual who has RME exposure, the estimate of the RME total risk is *not the simple sum of the RME risk estimates, because the most pathways are* independent of each other. For example, an individual with RME exposure from soil ingestion is not likely to also have RME exposure from groundwater ingestion (and vice versa). Thus, the estimate of RME total risk is conservatively calculated as:

$$\text{RME Risk}_{(\text{total})} = \text{RME Risk}_{(\text{exposure pathway with maximum RME risk})} + \text{CTE Risk}_{(\text{all other pathways})}$$

However, because the RME individual is assumed to have 30 years of exposure, it is also necessary to assume the individual has 30 years of CTE exposure (rather than 9 years, which is the usual CTE exposure duration). To account for this, the above equation is modified as follows:

$$\text{RME Risk}_{(\text{total})} = \text{RME Risk}_{(\text{exposure pathway with maximum RME risk})} + (30/9)*\text{CTE Risk}_{(\text{all other pathways})}$$

For example, the total risk to an individual exposed to surface soil and groundwater, where soil is the pathway contributing the maximum risk, RME risk would be computed as follows:

$$\text{RME Risk}_{(\text{total})} = \text{RME}_{(\text{surface soil})} + (30/9)*\text{CTE Risk}_{(\text{groundwater})}$$

The total risks to on-site hikers, on-site commercial workers on-site residents and off-site residents are shown in Tables 5-9 through 5-13 and are described for each receptor in the following sections.

5.4.2 Combined Risks to On-Site Hikers

Table 5-9 presents the total risks to hikers from the incidental ingestion of on-site surface soil, sediment and surface water during recreational activities. Total non-cancer and cancer risks to a CTE individual are below a level of concern at all locations, but exceed a level of concern to a RME individual at several locations. Non-cancer risks are driven by the incidental ingestion of metals in surface water with additional contributions from the ingestion of surface soil, with the exception of the AH&P area of the site and at 3 surface water/sediment exposure units (LA, LCPD and PDC) within the PCA area of the site. For exposures that occur in the AH&P area of the site, non-cancer risks are driven by the incidental ingestion of thallium in surface soil. Non-cancer risks in the southwestern area of the PCA exposure unit (at surface water/sediment exposure units LA, LCPD and PDC) are driven by both thallium and arsenic in surface soil. Cancer risks exceeding a 1E-04 level of concern are driven by arsenic in surface water with additional contributions from arsenic in sediment at some locations. Risks to hikers from lead are not of concern at any location.

These results indicate that risks from exposure to surface water, sediment and surface soil at the site are likely to be below a level of concern for most recreational visitors, but could be of potential concern to individuals with RME exposures if exposure were to occur repeatedly in some locations.

5.4.3 Combined Risks to On-Site Residents

Table 5-10 summarizes the total risks to hypothetical future on-site residents from the incidental ingestion of soil and groundwater. As seen, non-cancer risks are above a level of concern at all locations. Non-cancer risks at most locations are driven by ingestion groundwater at the site with additional contributions from soil ingestion. At two locations (well BED-8 and GE-MW-06), non-cancer risks are driven by the ingestion of thallium in surface soil with additional contributions from groundwater ingestion. Non-cancer risks from groundwater ingestion are driven by several metals (arsenic, cadmium, chromium, copper, iron, antimony, zinc, manganese, aluminum, and thallium) in both the dissolved and total fractions, whereas non-cancer risks from soil ingestion are driven by arsenic and thallium. Total cancer risks exceed a 1E-04 at all locations for a resident with RME exposure, and at several locations for a resident with CTE exposure. All cancer risks are due to the ingestion of arsenic in both surface soil and groundwater. The exposure pathway contributing the maximum cancer risk varies from location to location. Risks from lead would be of concern to residents at some locations due to the concentration of dissolved and total lead in groundwater.

These results indicate that concentrations of arsenic, lead and other metals in soil and groundwater would be of concern to hypothetical future residents.

5.4.4 Combined Risks to On-Site Commercial Workers

Table 5-11 summarizes the total risks to hypothetical future on-site commercial workers. Non-cancer risks to a worker with both CTE and RME exposures exceed a level of concern at all locations, with one exception (well GW-10A). These risks are almost entirely due to the ingestion of groundwater, with additional contributions from soil at some locations. The chemicals driving the non-cancer risks from groundwater ingestion vary from location to location and include arsenic, cadmium, chromium, copper, iron, antimony, zinc, manganese, aluminum, and thallium in both the dissolved and total fractions. The non-cancer risk driver for the soil ingestion exposure pathway is thallium. Total cancer risks exceed a 1E-04 level of concern at most locations for workers with RME exposure to site media and at a few locations for an individual with CTE exposure. These risks are driven by the groundwater ingestion pathway due to concentrations of dissolved and total arsenic. Risks from lead exceed EPA's health based goal (P10<5%) for a pregnant worker at 3 locations (wells CDM03b, CDM04b and GE-MW-08) due to ingestion of dissolved or total lead in groundwater.

These results indicate that concentrations of arsenic and lead and other metals in groundwater and the concentration of thallium in surface soil would be of concern to commercial workers under a future land use scenario.

5.4.5 Combined Risks to Off-Site Children

Table 5-12 presents the total risks to children playing in off-site drainages from surface water and sediment. Total non-cancer and cancer risks are below a level of concern at all locations. Risks from lead are also below a level of concern at all locations.

These results indicate that there is little risk to children or other recreational visitors who may have contact with surface water of sediment along off-site creeks and drainages.

5.4.6 Combined Risks to Off-Site Recreational Fishermen

Table 5-13 summarizes the total risks to recreational fisherman from the ingestion of sediment, surface water and fish in off-site drainages. As seen, non-cancer and cancer risks from surface water and sediment that are below a level of concern at all locations. Risks from lead are also below a level of concern at all locations.

These results indicate that there is little risk to recreational fisherman from ingestion of fish or who may have contact with surface water or sediment along off-site creeks.

6.0 UNCERTAINTIES

Quantitative evaluation of the risks to humans from environmental contamination is frequently limited by uncertainty regarding a number of key data items, including concentration levels in the environment, the true level of human contact with contaminated media, and the true dose response curves for non cancer and cancer effects in humans. This uncertainty is usually addressed by making assumptions or estimates for uncertain parameters based on whatever limited data are available. Because of these assumptions and estimates, the results of risk calculations are themselves uncertain, and it is important for risk managers and the public to keep this in mind when interpreting the results of a risk assessment. The following sections review the main sources of uncertainty in the risk calculations performed at the Gilt Edge site.

6.1 Uncertainties in Exposure Assessment

As described above, the risk assessment process begins with estimation of human exposure to potentially toxic chemicals in environmental media. There are multiple sources of uncertainty in these exposure estimates, as discussed below.

Uncertainties from Exposure Pathways Not Evaluated

As discussed in Section 3 (see Figure 3 1), humans may be exposed to site related chemicals by a number of pathways, but not all of these pathways were evaluated quantitatively in this risk assessment. For example, at this site, the following pathways were omitted: dermal exposure to soil, sediment, surface water, inhalation of dust in air (wind erosion), and ingestion of terrestrial food items. These pathways were omitted because it is believed these pathways contribute only a small amount of risk compared to one or more other pathways that were evaluated. In these cases, omission of the minor pathways will result in a small underestimation of exposure and risk, but the magnitude of this underestimation is not expected to be significant. In the case of dermal exposure to soil or water, the magnitude of the underestimation is generally presumed to be small, but this may vary between different chemicals and different exposure pathways, and might become significant in some cases (e.g., dermal contact for a construction worker). If so, that would result in an underestimation of risk to that population.

Uncertainties From Chemicals Not Evaluated

As discussed in Section 3.3, exposure and risk were quantified only for a selected subset (the COPCs) of chemicals detected in environmental media. In most cases, omission of other (non-COPC) chemicals is not a significant source of uncertainty, since the highest level of the chemical detected did not exceed a level of concern. However, some chemicals (bismuth, gold, scandium, titanium, tungsten, yttrium, zirconium) were not evaluated because no toxicity factor was available. This omission may tend to underestimate total risk, but the magnitude of the error is likely to be low This is because absence of a toxicity value is generally the result of a low level of concern over the chemical. Thus, chemicals that lack toxicity factors may contribute some added risk to exposed humans, but the level of added risk is not expected to be large.

Uncertainties in Exposure Point Concentrations

In all exposure calculations, the desired input parameter is the true mean concentration of a contaminant within a medium, averaged over the area where random exposure occurs. However, because the true mean cannot be calculated based on a limited set of measurements, the USEPA (1989, 1992) recommends that the exposure estimate be based on the 95% upper confidence limit (UCL) of the mean. When data are plentiful and inter sample variability is not large, the EPC may be only slightly higher than the mean of the data. However, when data are sparse or are highly variable, the EPC may be far greater than the mean of the available data. Such EPCs (substantially higher than the sample mean) reflect the substantial uncertainty that exists when data are sparse or highly variable, and in general are likely to result in an overestimate of risk.

At this site, the EPC was the 95th UCL or the maximum concentration. The 95th UCL was calculated when 10 or more sample results were available for a chemical. In cases where less than 10 sample results were available, the maximum concentration was used as the EPC. For soil and fish tissue, the number of samples available for each exposure unit was sufficient to calculate a 95th UCL and to limit the magnitude uncertainty introduced by a small data set. This is probably not a significant source of uncertainty in the risk estimates, unless the data are highly variable. The data sets for surface water, sediment and groundwater were somewhat more limited, and the maximum concentration was often used as the EPC at the majority of these exposure units. In cases where the inter sample variability is small, this is not likely to overestimate the mean concentration and risk estimates. However, in cases where the data are highly variable the maximum could result in an overestimate of risk. Overall, uncertainties in exposure point concentrations are more likely to overestimate than underestimate risks.

Uncertainties in Human Exposure Parameters

Accurate calculation of risk values requires accurate estimates of the level of human exposure that is occurring. However, many of the required exposure parameters are not known with certainty and must be estimated from limited data or knowledge. For example, data on the actual frequency and duration of exposures of current site visitors (hikers, ATV riders) are not known. Likewise, data are absent on the amount of exposure to site media (soil, water, sediment) by current or future on-site workers and visitors, and values were derived based mainly on professional judgment. In general, the exposure parameters were chosen in a way that was intended to be conservative. Therefore, the values selected are thought to be more likely to overestimate than underestimate actual exposure and risk.

Uncertainties in Chemical Absorption (RBA)

The risk from an ingested chemical depends on how much of the ingested chemical is absorbed from the gastrointestinal tract into the body. This issue is especially important for metals in soil at mining sites, because some of the metals may exist in poorly absorbable forms, and failure to account for this may result in a substantial overestimation of exposure and risk. In the absence of data, the default approach (followed in this document) is to assume that the RBA is 100% for most chemicals, with the exception of 50% for arsenic and 60% for lead in soil. Use of these default assumptions is more likely to overestimate than underestimate true exposures.

6.2 Uncertainties in Toxicity Values

Toxicity information for many chemicals is often limited. Consequently, there are varying degrees of uncertainty associated with toxicity values (i.e., cancer slope factors, reference doses). For example, uncertainties can arise from extrapolation from animal studies to humans, extrapolation from high dose to low dose, and extrapolation from continuous exposure to intermittent exposure. In addition, in some cases, only a few studies are available to characterize the toxicity of a chemical, and uncertainties exist not only in the dose response curve, but also in the nature and severity of the adverse effects which the chemical may cause. USEPA typically deals with this uncertainty by applying an uncertainty factor of 10 - 100 to account for limitations in the database. Thus, in cases where available data do identify the most sensitive endpoint of toxicity, risk estimates will substantially overestimate true hazard.

In general, uncertainty in toxicity factors is one of the largest sources of uncertainty in risk estimates at a site. Because of the conservative methods USEPA uses in dealing with the uncertainties, it is much more likely that the uncertainty will result in an overestimation rather than an underestimation of risk.

6.3 Uncertainties in Risk Estimates

A number of limitations are associated with the risk characterization approach for carcinogens and non-carcinogens.

First, because risk estimates for a chemical are derived by combining uncertain estimates of exposure and toxicity (see above), the risk estimates for each chemical are more uncertain than either the exposure estimate or the toxicity estimate alone. However, even if the risk estimates for individual chemicals were quite certain, there is considerable uncertainty in how to combine risk estimates across different chemicals. In some cases, the effects caused by one chemical do not influence the effects caused by other chemicals. In other cases, the effects of one chemical may interact with effects of other chemicals, causing responses that are approximately additive, greater than additive (synergistic), or less than additive (antagonistic). In most cases, available toxicity data are not sufficient to define what type of interaction is expected, so EPA generally assumes effects are additive for non carcinogens that act on the same target tissue and for carcinogens (all target tissues). Because documented cases of synergistic interactions between chemicals are relatively uncommon, this approach is likely to be conservative for most chemicals.

For non carcinogens, summing HQ values across different chemicals is properly applied only to compounds that induce the same effect by the same mechanism of action. Consequently, summation of HQ values for compounds that are not expected to include the same type of effects or that do not act by the same mechanisms could overestimate the potential for effects. Thus, all of the HI values in this report, which sum HQ values across multiple metals, are likely to overestimate the true level of human health non-cancer hazard.

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Table 2-1. Summary of Investigations Used in the Risk Assessment

INVESTIGATION	SAMPLE DATES	NUMBER OF SAMPLES					
		Surface Soil	Sub-surface Soil	Groundwater	Surface Water	Sediment	Fish Tissue
Anchor Hill Pit Study (CDM 2002a)	5/2001 - 8-2005				114	5	
Bank Material Study (CDM)	10/2005					38	
Compliance Monitoring (CDM)	1/2002 - 8/2005			81	269		
Groundwater Study (CDM 2003a)	9/2000 - 2/2004			162	8		
Human Health Risk Assessment Support (CDM)	10/2001	35					
O&M (CDM)	8/2002 - 5/2004				159		
Robertson Geochemical Reconnaissance Survey [1] (Robertson 2000)	7/2000	44	11				
Sediment Study (CDM)	10/2000 - 6/2002					108	
Site Wide Fill Material Study (CDM 2003b)	10/2001		28				
Site Wide Vegetation [2] (CDM)	10/2001	41	5				
Surface Water Study (CDM)	9/2000 - 2/2004						
Strawberry Creek Tailings Study (CDM)	2/2004					7	
Biomonitoring Study (USEPA 2002a)	9/2000					7	63

[1] Note surface soil samples collected during from the Ruby Gulch Waste Rock Repository (RGWRR) during this study that now underlie the soil cap have been re-classified as sub-surface samples.

[2] Stockpile samples (surface and sub-surface) used as soil cover at the RGWRR have been reclassified (as needed) as surface soil samples from the RGWRR area of the site.

Table 2-2. Summary Statistics for Chemicals Measured in Surface Soil

Chemical	Detection Frequency	Concentration [1] (mg/kg)		
		Minimum	Maximum	Average
Aluminum	100%	2500	15000	6800
Antimony	35%	0.31	10	2.2
Arsenic	100%	10	1400	170
Barium	100%	20	280	100
Beryllium	96%	0.17	2.5	0.89
Bismuth	91%	2.5	250	40
Cadmium	60%	0.04	17	1.2
Calcium	100%	100	43000	4300
Chromium	100%	1.8	260	55
Cobalt	100%	1	50	9.3
Copper	100%	3.3	1200	150
Cyanide	45%	0.02	0.93	0.18
Iron	100%	12000	150000	39000
Lead	100%	22	3700	290
Magnesium	100%	200	8400	2000
Manganese	100%	20	10000	830
Mercury	49%	0.024	0.15	0.051
Molybdenum	100%	4	280	32
Nickel	100%	2.9	110	11
Phosphorus	100%	100	3200	670
Potassium	100%	820	11000	2400
Scandium	95%	0.5	5	1.9
Selenium	49%	0.26	7.2	1.2
Silver	69%	0.1	22	2.2
Sodium	100%	100	5700	1000
Strontium	100%	20	310	92
Sulfur	100%	0.04	0.48	0.17
Thallium	36%	0.43	900	62
Tin	0%	5	5	5
Tungsten	30%	5	10	6.5
Vanadium	100%	5	100	25
Ytrium	100%	3	44	12
Zinc	100%	39	7300	320
Zirconium	100%	9	46	18

[1] Nondetects adjusted to 1/2 detection limit

Table 2-3. Summary Statistics for Chemicals Measured in Subsurface Soil

Chemical	Detection Frequency	Concentration [1] (mg/kg)		
		Minimum	Maximum	Average
Aluminum	100%	1600	14000	6600
Antimony	14%	0.37	12	1.9
Arsenic	100%	14	380	110
Barium	100%	16	890	130
Beryllium	59%	0.18	2.5	1
Bismuth	91%	2.5	70	18
Cadmium	73%	0.046	7	1.3
Calcium	100%	400	21000	3400
Chromium	73%	1.3	190	31
Cobalt	100%	1.8	56	9.5
Copper	100%	17	460	100
Cyanide	9%	0.04	2.7	0.28
Iron	100%	12000	90000	35000
Lead	100%	22	1200	190
Magnesium	100%	400	6000	2000
Manganese	100%	15	3800	870
Mercury	18%	0.026	0.6	0.091
Molybdenum	100%	4	32	13
Nickel	89%	0.38	160	11
Phosphorus	100%	120	1000	610
Potassium	100%	770	8000	2100
Scandium	91%	0.5	4	2.1
Selenium	18%	0.48	1.7	0.7
Silver	36%	0.1	8.4	1.3
Sodium	82%	30	1500	220
Strontium	100%	30	78	52
Sulfur	100%	0.04	1.7	0.35
Thallium	20%	0.5	800	80
Tin	0%	5	5	5
Tungsten	9%	5	10	5.5
Vanadium	100%	2.9	67	24
Ytrium	100%	5	36	17
Zinc	100%	51	1100	210
Zirconium	100%	8	27	18

[1] Nondetects adjusted to 1/2 detection limit

Table 2-4. Summary Statistics for Chemicals Measured in Groundwater

Chemical	Analysis Type	Detection Frequency	Concentration [1] (ug/L)		
			Minimum	Maximum	Average
Aluminum	Dissolved	70%	5	890000	31000
	Total Recoverable	85%	3.6	930000	34000
Antimony	Dissolved	5%	1	58	8.3
	Total Recoverable	7%	0.85	36	8.4
Arsenic	Dissolved	41%	1	520	22
	Total Recoverable	54%	1	800	34
Barium	Dissolved	88%	1.1	460	120
	Total Recoverable	93%	1.3	460	40
Beryllium	Dissolved	44%	0.05	59	6.5
	Total Recoverable	50%	0.05	59	6.6
Cadmium	Dissolved	57%	0.1	1100	68
	Total Recoverable	63%	0.1	1000	71
Calcium	Dissolved	100%	8700	680000	200000
	Total Recoverable	100%	10000	690000	210000
Chromium	Dissolved	32%	0.15	1000	32
	Total Recoverable	55%	0.23	1000	35
Cobalt	Dissolved	64%	0.35	490	100
	Total Recoverable	69%	0.3	530	95
Copper	Dissolved	63%	0.48	330000	6300
	Total Recoverable	80%	0.45	280000	6000
Cyanide	Dissolved	22%	0.4	30	2.7
	Total Recoverable	2%	1	16	5
Iron	Dissolved	78%	3.5	1400000	50000
	Total Recoverable	97%	9	1700000	60000
Lead	Dissolved	37%	0.5	1500	50
	Total Recoverable	67%	0.5	2400	74
Magnesium	Dissolved	97%	82	460000	59000
	Total Recoverable	99%	220	370000	65000
Manganese	Dissolved	97%	0.15	92000	7300
	Total Recoverable	97%	1.4	94000	7200
Mercury	Dissolved	5%	0.04	1.6	0.092
	Total Recoverable	14%	0.05	3.2	0.13
Nickel	Dissolved	85%	0.65	2000	170
	Total Recoverable	89%	0.7	2000	160
Nitrate	Dissolved	57%	25	7900	1500
	Total Recoverable	60%	25	20000	2500
Nitrite	Dissolved	100%	200	650	420
	Total Recoverable	6%	25	250	53
Phosphorus	Total Recoverable	13%	250	830	320
Potassium	Dissolved	97%	460	37000	7900
	Total Recoverable	100%	1000	36000	8000
Selenium	Dissolved	11%	1.2	47	5
	Total Recoverable	12%	1.2	52	5.3
Silver	Dissolved	6%	0.2	29	1.8
	Total Recoverable	17%	0.2	14	1.9
Sodium	Dissolved	99%	1000	940000	77000
	Total Recoverable	100%	1800	1000000	71000
Strontium	Total Recoverable	100%	50	870	430
Thallium	Dissolved	14%	1.6	51	5.9
	Total Recoverable	14%	1.6	60	5.9
Vanadium	Dissolved	16%	0.2	860	20
	Total Recoverable	36%	0.25	790	22
Zinc	Dissolved	87%	1.9	36000	2900
	Total Recoverable	88%	0.55	37000	2900

[1] Nondetects assumed to 1/2 detection limit

Table 2-5. Summary Statistics for Chemicals Measured in Surface Water

Chemical	Analysis Type	Detection Frequency	Concentration [1] (ug/L) Minimum	Concentration [1] (ug/L) Maximum	Concentration [1] (ug/L) Average	Concentration [1] (ug/L) Minimum	Concentration [1] (ug/L) Maximum	Concentration [1] (ug/L) Average
Aluminum	Dissolved	57%	3.7	1,090,000.0	32,629.4	3.6	1100000	33000
	Total Recoverable	81%	3.7	1,090,000.0	40,963 1	3 6	1100000	41000
Antimony	Dissolved	6%	0.9	100.0	5.8	0.85	100	5.8
	Total Recoverable	2%	0.9	110.0	5.8	0.85	110	5.8
Arsenic	Dissolved	35%	0.5	6,790.0	179.3	0.5	6800	180
	Total Recoverable	32%	0.6	6,790.0	172.4	0.55	6800	170
Barium	Dissolved	93%	0.3	408.0	110.8	0.3	410	110
	Total Recoverable	86%	0.2	145.0	24.1	0.2	140	24
Beryllium	Dissolved	29%	0.1	70.9	4.5	0.05	71	4.5
	Total Recoverable	34%	0.0	86.0	5.6	0.03	86	5.6
Boron	Dissolved	0%	50.0	50.0	50.0	50	50	50
	Total Recoverable	0%	50.0	50.0	50 0	50	50	50
Cadmium	Dissolved	55%	0.1	1,990.0	98.2	0.1	2000	100
	Total Recoverable	60%	0.1	1,720.0	93.7	0.1	1700	94
Calcium	Dissolved	99%	3.8	1,020,000 0	247,234.5	3.8	1000000	250000
	Total Recoverable	98%	8.7	1,500,000.0	257,613.3	8.7	1500000	260000
Chromium	Dissolved	32%	0.2	604.0	17.7	0.15	600	18
	Total Recoverable	34%	0.2	620.0	22.8	0.15	620	23
Cobalt	Dissolved	73%	0.4	1,460.0	145.8	0.35	1500	150
	Total Recoverable	80%	0.4	999.0	167.2	0.35	1000	170
Copper	Dissolved	67%	0.3	156,000.0	7,892.9	0.25	160000	7900
	Total Recoverable	73%	0.3	161,000.0	7,778.9	0 25	160000	7800
Cyanide	Dissolved	25%	0.2	40,200.0	206.6	0.2	40000	210
	Total Recoverable	19%	1.0	13,900.0	95.0	1	14000	100
Gold	Dissolved	100%	140.0	250.0	196.0	140	250	200
	Total Recoverable	100%	140.0	240.0	202.0	140	240	200
Iron	Dissolved	42%	5.3	1,840,000.0	49,256.0	5.3	1800000	49000
	Total Recoverable	74%	0.0	1,840,000.0	51,172.0	0	1800000	51000
Lead	Dissolved	13%	0.4	86.7	3.5	0.4	87	3.5
	Total Recoverable	27%	0.4	100.0	5.2	0.4	100	5.2
Lithium	Dissolved	100%	45.0	150.0	98.3	45	150	100
	Total Recoverable	100%	37.0	160.0	92.5	37	160	92
Magnesium	Dissolved	99%	2.3	428,000.0	51,488.7	2.2	430000	51000
	Total Recoverable	98%	6.9	760,000.0	67,611.9	6.9	760000	68000
Manganese	Dissolved	92%	0.2	55,100.0	9,373.8	0.15	55000	9400
	Total Recoverable	88%	0.2	57,500.0	7,656.7	0.15	58000	7700
Mercury	Dissolved	2%	0.1	1.5	0.1	0.05	1.5	0.1
	Total Recoverable	4%	0.0	6.3	0.1	0.04	6.3	0.12
Molybdenum	Dissolved	0%	5.0	5.0	5.0	5	5	5
	Total Recoverable	0%	5.0	5.0	5.0	5	5	5
Nickel	Dissolved	68%	0.4	2,070.0	152.9	0.35	2100	150
	Total Recoverable	69%	0.4	2,190.0	183.5	0.35	2200	180
Nitrate	Dissolved	90%	25.0	314,000.0	42,247.4	25	310000	42000
	Total Recoverable	93%	25.0	391,000.0	36,601.7	25	390000	37000
Nitrite	Dissolved	0%	25.0	25.0	25.0	25	25	25
	Total Recoverable	4%	25.0	182.0	30.6	25	180	31

Table 2-5. Summary Statistics for Chemicals Measured in Surface Water

Chemical	Analysis Type	Detection Frequency	Concentration [1] (ug/L)			Concentration [1] (ug/L)		
			Minimum	Maximum	Average	Minimum	Maximum	Average
Phosphorus	Dissolved	0%	250.0	250.0	250.0	250	250	250
	Total Recoverable	74%	3.0	3,100.0	181.2	3	3100	180
Potassium	Dissolved	95%	15.5	60,600.0	9,715 3	16	61000	10000
	Total Recoverable	95%	11.0	62,700.0	9,159.2	11	63000	9200
Selenium	Dissolved	41%	1.1	239.0	10.8	1	240	11
	Total Recoverable	33%	1.1	298.0	9.2	1	300	9.2
Silver	Dissolved	8%	0.2	210.0	4.1	0.2	210	4.1
	Total Recoverable	9%	0.2	210.0	3.6	0.2	210	3.6
Sodium	Dissolved	97%	9.2	2,430,000.0	361,508.7	9.2	2400000	360000
	Total Recoverable	98%	46.9	2,500,000.0	366,499.9	47	2500000	370000
Strontium	Dissolved	100%	1,400.0	2,700.0	2,287.5	1400	2700	2300
	Total Recoverable	68%	150.0	2,850.0	815.2	150	2800	820
Thallium	Dissolved	17%	0.9	89.0	6.4	0.85	89	6.4
	Total Recoverable	13%	0.9	71.0	6.0	0.85	71	6
Tin	Dissolved	0%	5.0	5.0	5.0	5	5	5
	Total Recoverable	0%	5.0	5.0	5.0	5	5	5
Titanium	Dissolved	0%	2.5	2.5	2.5	2.5	2.5	2.5
	Total Recoverable	0%	2.5	2.5	2.5	2.5	2.5	2.5
Vanadium	Dissolved	10%	0.3	450.0	6.5	0.25	450	6.5
	Total Recoverable	14%	0.3	440.0	6.9	0.25	440	6.9
Zinc	Dissolved	74%	0.3	41,400.0	2,460.2	0.3	41000	2500
	Total Recoverable	74%	0.4	37,200.0	2,319.3	0.35	37000	2300

[1] Nondetects adjusted to 1/2 detection limit

Table 2-6. Summary Statistics for Chemicals Measured in Sediment

Chemical	Detection Frequency	Concentration [1] (mg/kg)		
		Minimum	Maximum	Average
Aluminum	100%	1100	150000	23000
Antimony	14%	0.24	80	4.4
Arsenic	96%	2.9	1200	110
Barium	99%	2.1	510	110
Beryllium	83%	0.02	20	1.8
Cadmium	80%	0.03	310	14
Calcium	98%	130	220000	13000
Chromium	100%	1.6	100	20
Cobalt	97%	0.21	540	41
Copper	100%	4.7	25000	1600
Cyanide	50%	0.028	16	0.67
Iron	100%	2100	240000	41000
Lead	100%	8	2100	130
Magnesium	100%	200	42000	6100
Manganese	100%	12	15000	1700
Mercury	38%	0.025	2	0.18
Nickel	99%	2.3	440	47
Potassium	99%	63	7700	3000
Selenium	44%	0.25	9.2	2
Silver	81%	0.07	22	2.7
Sodium	96%	75	33000	2100
Thallium	22%	0.44	16	1.9
Vanadium	98%	0.9	140	32
Zinc	99%	6	7400	660

[1] Nondetects adjusted to 1/2 detection limit

Table 2-7. Summary Statistics for Chemicals Measured in Fish Tissue

Chemical	Detection Frequency	Concentration [1] (mg/kg ww)		
		Minimum	Maximum	Average
Aluminum	38%	1	160	25
Antimony	0%	0.15	6	1.5
Arsenic	76%	0.056	1.4	0.53
Barium	33%	1	20	6.7
Beryllium	0%	0.012	0.5	0.14
Cadmium	65%	0.076	1	0.35
Calcium	98%	1100	14000	7200
Chromium	29%	0.05	24	0.87
Cobalt	19%	0.066	5	1.8
Copper	70%	0.25	4.4	1.7
Iron	84%	1	410	85
Lead	78%	0.015	1.2	0.2
Magnesium	100%	72	430	310
Manganese	98%	0.3	100	19
Mercury	75%	0.0028	0.1	0.027
Nickel	6%	0.2	17	1.9
Potassium	100%	600	3800	2700
Selenium	100%	0.12	1.6	0.9
Silver	0%	0.05	1	0.34
Sodium	97%	50	1200	860
Thallium	0%	0.025	0.5	0.21
Vanadium	0%	0.25	5	2
Zinc	100%	7.7	48	29

[1] Nondetects adjusted to 1/2 detection limit
ww = wet weight

Table 3-1. Quantitative Chemicals of Potential Concern for the Human Health Risk Assessment

CHEMICAL	SOIL	SEDIMENT	SURFACE WATER	GROUNDWATER	FISH TISSUE
Aluminum	X	X	X	X	X
Antimony	X	X		X	
Arsenic	X	X	X	X	X
Barium					
Beryllium		X	X	X	
Bismuth					
Boron					
Cadmium	X	X	X	X	X
Calcium					
Chromium	X	X	X	X	X
Cobalt		X	X	X	X
Copper	X	X	X	X	
Cyanide			X		
Gold					
Iron	X	X	X	X	X
Lead	X	X	X	X	
Lithium			X		
Magnesium					
Manganese	X	X	X	X	X
Mercury				X	X
Molybdenum	X				
Nickel	X	X	X	X	X
Nitrate			X	X	
Nitrite				X	
Phosphorus					
Potassium					
Scandium					
Selenium			X	X	X
Silver			X	X	
Sodium					
Strontium			X		
Thallium	X	X	X	X	
Tin					
Titanium					
Tungsten					
Vanadium	X	X	X	X	
Ytrium					
Zinc	X	X	X	X	X
Zirconium					

Table 3-2. Qualitative Chemicals of Potential Concern
for the Human Health Risk Assessment

CHEMICAL	SOIL	SEDIMENT	SURFACE WATER	GROUNDWATER	FISH TISSUE
Aluminum					
Antimony					
Arsenic					
Barium					
Beryllium					
Bismuth	X				
Boron					
Cadmium					
Calcium					
Chromium					
Cobalt					
Copper					
Cyanide					
Gold			X		
Iron					
Lead					X
Lithium					
Magnesium					
Manganese					
Mercury					
Molybdenum					
Nickel					
Nitrate					
Nitrite					
Phosphorus					
Potassium					
Scandium	X				
Selenium					
Silver					
Sodium					
Strontium					
Thallium					
Tin					
Titanium			X		
Tungsten	X				
Vanadium					
Yitrium	X				
Zinc					
Zirconium	X				

Table 3-3
Exposure Parameters for Recreational Visitor (ATV Rider)

Exposure Pathway	Exposure Input Parameter	Units	CTE		RME	
			Adult	Source	Adult	Source
General	Body Weight	kg	70	[1, 3]	70	[1, 3]
	Exposure Frequency	days/yr	19.5	[5, 6, a]	100	[5, 6, a]
	Exposure Duration	yr	9	[3]	30	[3]
	Averaging Time, Cancer	yr	70	[2]	70	[2]
	Averaging Time, Noncancer	yr	9	[2]	30	[2]
Inhalation of Particulates	Inhalation rate	m^3/hr	2.4	[4, 7, b]	2.4	[4, 7, b]
	Exposure Time	hr/day	1.5	[5, 8]	2.5	[5, 8]
Ingestion of Soil	Intake rate	mg/day	50	[5, c]	100	[5, c]
	Conversion factor	kg/mg	1E-06	--	1E-06	--

CTE = Central Tendency Exposure
RME = Reasonable Maximum Exposure

Sources:

[1] USEPA 1991. Human Health Evaluation Manual, Supplemental Guidance: Standard Default Exposure Factors. OSWER Directive 9285.6-03. March.

[2] USEPA 1989. Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Part A). Office of Emergency and Remedial Response, Washington, D.C. EPA/540/1-89/002. December.

[3] USEPA 1993. Superfund's Standard Default Exposure Factors for the Central Tendency and Reasonable Maximum Exposure.

[4] USEPA 1997. Exposure Factors Handbook.

[5] Professional judgment.

[6] Jefferson County, Colorado Open Space 1996. Jefferson County Open Space Trail Usage Survey. Golden, CO.

[7] USEPA 2001. Rocky Flats Task 3 Report.

[8] Boulder County Open Space Operations 1995. Boulder County Open Space Park Usage Survey. Boulder, CO.

Notes:

[a] Based on a survey of 779 persons in Jefferson County, Colorado, that collected information on the number of visits recreational users annually make to open space parks in Jefferson County. The arithmatic mean (39 visits/year) and 90th percentile (100 visits/year) of the total number of visits per year were calculated from the survey and used for the CTE and RME exposure frequency values, respectively. CTE and RME values were multiplied by 0.5 and 1.0, respectively to represent that 50% and 100% of recreational visits occur at the Gilt Edge Site.
[b] Mean breathing rate for moderate and heavy activities (USEPA 1997, Table 5-23).
[c] Assumes soil ingestion is two times the soil ingestion rate of a low-intensity visitor.

Table 3-4
Exposure Parameters for Recreational Visitor (Hiker)

Exposure Pathway	Exposure Input Parameter	Units	CTE				RME			
			Adult	Source	Child	Source	Adult	Source	Child	Source
General	Body Weight	kg	70	[1, 3]	15	[1, 3]	70	[1, 3]	15	[1, 3]
	Exposure frequency (soil, air)	days/yr	19.5	[5, 6, a]	19.5	[5, 6, a]	100	[5, 6, a]	100	[5, 6, a]
	Exposure frequency (surface water, sediment)	days/yr	2.0	[5, f]	2.0	[5, f]	10	[5, f]	10	[5, f]
	Exposure duration	yr	7	[3]	2	[3]	24	[3]	6	[3]
	Averaging Time, Cancer	yr	70	[2]	70	[2]	70	[2]	70	[2]
	Averaging Time, Noncancer	yr	9	[2]	9	[2]	30	[2]	30	[2]
Ingestion of Soil	Ingestion rate	mg/day	25	[5, d]	50	[5, d]	50	[5, c]	100	[5, c]
	Conversion factor	kg/mg	1E-06	--	1E-06	--	1E-06	--	1E-06	--
Ingestion of Sediment	Ingestion rate	mg/day	12.5	[5, d]	25	[5, d]	25	[5, e]	50	[5, e]
	Conversion factor	kg/mg	1E-06	--	1E-06	--	1E-06	--	1E-06	--
Ingestion of Surface Water	Ingestion rate	mL/hour	5	[5, h]	5	[5, h]	30	[9, g]	30	[9, g]
	Exposure Time	hr/day	0.5	[5, 10]	0.5	[5, 10]	1.5	[5, 10]	1.5	[5, 10]
	Conversion factor	L/mL	1E-03	--	1E-03	--	1E-03	--	1E-03	--

CTE = Central Tendency Exposure
RME = Reasonable Maximum Exposure

Sources:

[1] USEPA 1991. Human Health Evaluation Manual, Supplemental Guidance: Standard Default Exposure Factors. OSWER Directive 9285.6-03. March.

[2] USEPA 1989. Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Part A). Office of Emergency and Remedial Response, Washington, D.C. EPA/540/1-89/002. December.

[3] USEPA 1993. Superfund's Standard Default Exposure Factors for the Central Tendency and Reasonable Maximum Exposure.

[4] USEPA 1997. Exposure Factors Handbook.

[5] Professional judgment.

[6] Jefferson County, Colorado Open Space 1996. Jefferson County Open Space Trail Usage Survey. Golden, CO.

[7] USEPA 2001. Rocky Flats Task 3 Report.

[8] Boulder County Open Space Operations 1995. Boulder County Open Space Park Usage Survey. Boulder, CO.

[9] USEPA 1998. Draft Water Quality Criteria Methodology Revisions.

[10] SAF 2000. Final. Remedial Investigation Report. Zone A. Operable Unit 3: Landfill 6. Volume 3. Appendix K. Baseline Risk Assessment May 15. (FE Warren Site).

Notes:

[a] Based on a survey of 779 persons in Jefferson County, Colorado, that collected information on the number of visits recreational users annually make to open space parks in Jefferson County. The arithmatic mean (39 visits/year) and 90th percentile (100 visits/year) of the total number of visits per year were calculated from the survey and used for the CTE and RME exposure frequency values, respectively. CTE and RME values were multiplied by 0.5 and 1.0, respectively to represent that 50% and 100% of recreational visits occur at the Gilt Edge Site.

[b] Mean breathing rate for moderate and heavy activities (USEPA 1997, Table 5-23).

[c] Assumes RME soil ingestion by a recreational visitor is half of the USEPA default soil ingestion rate for a resident.

[d] Assumes CTE ingestion rate is half of the RME ingestion rate.

[e] Assumes RME sediment ingestion is same as CTE soil ingestion.

[f] Assumes that exposure to surface water and sediment occurs during 1 out of every 10 visits to the site (10% of visits).

[g] 30 mL/hr is the basis for the 10 mL/day value proposed for a recreational scenario by the Draft Water Quality Criteria Methodology Revisions (USEPA 1998)

[h] Incidental ingestion from splashing or hand-to-face contact during wading assumed to be 10% of USEPA (1989) recommended default (50 ml/hr) incidentally ingested during swimming.

Table 3-5
Exposure Parameters for Construction Workers

Exposure Pathway	Exposure Input Parameter	Units	CTE		RME	
			Adult	Source	Adult	Source
General	Body Weight	kg	70	[1, 3]	70	[1, 3]
	Exposure frequency	day/yr	219	[3]	250	[3]
	Exposure duration	yr	0.5	[7, a]	1	[7]
	Averaging Time, Cancer	yr	70	[1, 2, 3]	70	[1, 2, 3]
	Averaging Time, Noncancer	yr	0.5	[2]	1	[2]
Inhalation of Particulates	Inhalation rate	m^3/hr	2.4	[5, b]	2.4	[5, b]
	Exposure time	hr/day	8	[6, c]	8	[6, c]
Ingestion of Soil	Ingestion rate	mg/day	165	[6, a]	330	[4]
	Conversion factor	kg/mg	1.00E-06	--	1.00E-06	--

CTE = Central Tendency Exposure
RME = Reasonable Maximum Exposure

Sources:
[1] USEPA 1991. Human Health Evaluation Manual, Supplemental Guidance: Standard Default Exposure Factors.
[2] USEPA 1989. Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Part A).
[3] USEPA 1993. Superfund's Standard Default Exposure Factors for the Central Tendency and Reasonable Maximum Exposure.
[4] USEPA 2002. Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. OSWER 9355.4-24. December.
[5] USEPA 1997. Exposure Factors Handbook.
[6] Professional judgment

Notes:
[a] Assumes CTE value is half of the RME value.
[b] Mean breathing rate for moderate and heavy activities (USEPA 1997, Table 5-23).
[c] Assumes 8 hour workday.

Table 3-6
Exposure Parameters for Commercial Workers

Exposure Pathway	Exposure Input Parameter	Units	CTE		RME	
			Adult	Source	Adult	Source
General	Body Weight	kg	70	[1, 3]	70	[1, 3]
	Exposure frequency	day/yr	219	[3]	250	[3]
	Exposure duration	yr	5	[3]	25	[4]
	Averaging Time, Cancer	yr	70	[1, 2, 3]	70	[1, 2, 3]
	Averaging Time, Noncancer	yr	5	[3]	25	[3]
Ingestion of Soil	Ingestion rate	mg/day	25	[6, c]	50	[4]
	Conversion factor	kg/mg	1.00E-06	--	1.00E-06	--
Ingestion of Groundwater	Ingestion rate	L/d	0.7	[5, b]	1	[1]

CTE = Central Tendency Exposure
RME = Reasonable Maximum Exposure

Sources:

[1] USEPA 1991. Human Health Evaluation Manual, Supplemental Guidance: Standard Default Exposure Factors. OSWER Directive 9285.6-03. March.

[2] USEPA 1989. Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Part A). Office of Emergency and Remedial Response, Washington, D.C. EPA/540/1-89/002. December.

[3] USEPA 1993. Superfund's Standard Default Exposure Factors for the Central Tendency and Reasonable Maximum Exposure.

[4] USEPA 2002. *Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites.* OSWER 9355.4-24. December.

[5] USEPA 1997. Exposure Factors Handbook.

[6] Professional judgment.

Notes:

[a] Breathing rates are based on the means for long-term exposure (Table 5-23). The value for adults is the average of the means for males and for females.

[b] Assumes CTE value for worker is half of the CTE value for a resident.

Table 3-7
Exposure Parameters for Future Residents

Exposure Pathway	Exposure Parameter	Units	CTE				RME			
			Adult	Source	Child	Source	Adult	Source	Child	Source
General	Body Weight	kg	70	[1, 3]	15	[1, 3]	70	[1, 3]	15	[1, 3]
	Exposure frequency	days/yr	234	[3]	234	[3]	350	[3]	350	[3]
	Exposure duration	years	7	[3]	2	[3]	24	[3]	6	[3]
	Averaging Time, Cancer	yr	70	[2]	70	[2]	70	[2]	70	[2]
	Averaging Time, Noncancer	yr	9	[2]	9	[2]	30	[2]	30	[2]
Ingestion of Soil	Ingestion rate	mg/day	50	[3]	100	[3]	100	[1,3]	200	[1,3]
	Conversion factor	kg/mg	1.00E-06	--	1.00E-06	--	1.00E-06	--	1.00E-06	--
Ingestion of Groundwater	Ingestion rate	L/d	1.4	[1, 2, 3]	0.7	[5, a]	2	[1, 2, 3]	1	[5, a]

CTE = Central Tendency Exposure
RME = Reasonable Maximum Exposure

Sources:
[1] USEPA 1991. Human Health Evaluation Manual, Supplemental Guidance: Standard Default Exposure Factors. OSWER Directive 9285.6-03. March.
[2] USEPA 1989. Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Part A). Office of Emergency and Remedial Response, Washington,
[3] USEPA 1993. Superfund's Standard Default Exposure Factors for the Central Tendency and Reasonable Maximum Exposure.
[4] USEPA 1997. Exposure Factors Handbook.
[5] Professional judgment.

Notes:
[a] Child resident intake assumed to be half that of an adult resident.
[b] Calculated value.

Table 3-8
Exposure Parameters for Riparian Area Recreational Fisherman (Adult)

Exposure Pathway	Exposure Input Parameter	Units	CTE		RME	
			Adult	Source	Adult	Source
General	Body Weight	kg	70	[1, 3]	70	[1, 3]
	Exposure Frequency	days/yr	2	[5, 6, a]	10	[5, 6, a]
	Exposure duration	yr	7	[3]	24	[3]
	Averaging Time, Cancer	yr	70	[2]	70	[2]
	Averaging Time, Noncancer	yr	7	[2]	24	[2]
Ingestion of Fish	Ingestion rate (total)	g/day	8	[4, b]	25	[4, b]
	Conversion factor	kg/g	1E-03	--	1E-03	--
	Fraction from Site/Site Impacted areas	unitless	0.10	[5, c]	0.20	[5, c]
Ingestion of Sediment	Ingestion rate	mg/day	12.5	[5, d]	25	[5, e]
	Conversion factor	kg/mg	1E-06	--	1E-06	--
Ingestion of Surface Water	Ingestion rate	mL/hour	5	[5, g]	30	[7, f]
	Exposure Time	hr/day	0.5	[5, 8]	1.5	[5, 8]
	Conversion factor	L/mL	1E-03	--	1E-03	--

CTE = Central Tendency Exposure
RME = Reasonable Maximum Exposure

Sources:

[1] USEPA 1991. Human Health Evaluation Manual, Supplemental Guidance: Standard Default Exposure Factors. OSWER Directive 9285.6-03. March.

[2] USEPA 1989. Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Part A). Office of Emergency and Remedial Response, Washington, D.C. EPA/540/1-89/002. December.

[3] USEPA 1993. Superfund's Standard Default Exposure Factors for the Central Tendency and Reasonable Maximum Exposure.

[4] USEPA 1997. Exposure Factors Handbook.

[5] Professional judgment.

[6] Jefferson County, Colorado Open Space 1996. Jefferson County Open Space Trail Usage Survey. Golden, CO.

[7] USEPA 1998. Draft Water Quality Criteria Methodology Revisions.

[8] SAF. 2000. Final. Remedial Investigation Report. Zone A. Operable Unit 3: Landfill 6. Volume 3. Appendix K. Baseline Risk Assessment May 15. (FE Warren Site).

Notes:

[a] Assumes exposure frequency is same as low-intensity recreational visitor.

[b] From Section 10.10.3, recommendations for recreational freshwater anglers. RME is equivalent ot 58 meals/year and CTE is equivalent to 19 meals/year (150 g/meal).

[c] assumes 10% and 20% of fish consumed annually are from the Gilt Edge Site/areas impacted by the Gilt Edge Site.

[d] Assumes CTE ingestion rate is half of the RME ingestion rate.

[e] Assumes RME sediment ingestion is same as CTE soil ingestion.

[f] 30 mL/hr is the basis for the 10 mL/day value proposed for a recreational scenario by the Draft Water Quality Criteria Methodology Revisions (USEPA 1998).

[g] Incidental ingestion from splashing or hand-to-face contact during wading assumed to be 10% of USEPA (1989) recommended default (50 ml/hr) incidentally ingested during swimming.

Table 3-9
Exposure Parameters for Riparian Area Residential Child

Exposure Pathway	Exposure Input Parameter	Units	CTE		RME	
			Child	Source	Child	Source
General	Body Weight	kg	33	[4, a]	33	[4, a]
	Exposure Frequency	days/yr	44	[5, b]	88	[5, b]
	Exposure duration	yr	2	[3]	6	[3]
	Averaging Time, Cancer	yr	70	[2]	70	[2]
	Averaging Time, Noncancer	yr	2	[2]	6	[2]
Ingestion of Sediment	Ingestion rate	mg/day	25	[5, d]	50	[5, e]
	Conversion factor	kg/mg	1E-06	--	1E-06	--
Ingestion of Surface Water	Ingestion rate	mL/hour	5	[5, h]	30	[7, g]
	Exposure Time	hr/day	0.5	[5, 8]	1.5	[5, 8]
	Conversion factor	L/mL	1E-03	--	1E-03	--

CTE = Central Tendency Exposure
RME = Reasonable Maximum Exposure

Sources:

[1] USEPA 1991. Human Health Evaluation Manual, Supplemental Guidance: Standard Default Exposure Factors. OSWER
[2] USEPA 1989. Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Part A). Office of Emergency and Remedial Response, Washington, D.C. EPA/540/1-89/002. December.
[3] USEPA 1993. Superfund's Standard Default Exposure Factors for the Central Tendency and Reasonable Maximum Exposure.
[4] USEPA 1997. Exposure Factors Handbook.
[5] Professional judgment.
[6] Jefferson County, Colorado Open Space 1996. Jefferson County Open Space Trail Usage Survey. Golden, CO.
[7] USEPA 1998. Draft Water Quality Criteria Methodology Revisions.
[8] SAF. 2000. Final. Remedial Investigation Report. Zone A. Operable Unit 3: Landfill 6. Volume 3. Appendix K. Baseline Risk Assessment May 15. (FE Warren Site).
[9] USEPA 2004. Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment). OSWER 9285.7-02EP. July.

Notes:

[a] Table 7-3, mean of male and female ages 6 - 12.
[b] Assumes exposure occurs May-September at a frequency of 2 visits/week and 4 visits/week, for a CTE and RME child, respectively.
[c] assumes 10% and 20% of fish consumed annually are from the Gilt Edge Site/areas impacted by the Gilt Edge Site.
[d] Assumes CTE ingestion rate is half of the RME ingestion rate.
[e] Assumes RME sediment ingestion is same as CTE soil ingestion.
[f] Assumes exposure frequency is same as low-intensity recreational visitor.
[g] 30 mL/hr is the basis for the 10 mL/day value proposed for a recreational scenario by the Draft Water Quality Criteria Methodology Revisions (USEPA 1998).
[h] Incidental ingestion from splashing or hand-to-face contact during wading assumed to be 10% of USEPA (1989) recommended default (50 ml/hr) incidentally ingested during swimming.
[i] Default for inorganic chemicals.
[j] Assumes exposure of hands, forearms, lower legs, and feet. Average of male and females, (USEPA 1997, Tables 6-6 and 6-7 for child ages 2-18).
[k] Assumes soil and sediment adherence factors are two times that of USEPA 2004 (Exhibit 3-5) recommended soil adherence factors for a resident.
[l] Child resident intake assumed to be half of an adult resident intake.

Table 3-10
Exposure Parameters for Riparian Area Resident

Exposure Pathway	Exposure Input Parameter	Units	CTE				RME			
			Adult	Source	Child	Source	Adult	Source	Child	Source
General	Body Weight	kg	70	[1, 3]	15	[1, 3]	70	[1, 3]	15	[1, 3]
	Exposure Frequency	days/yr	234	[3, a]	234	[5, 6, a]	350	[3, a]	350	[5, 6, a]
	Exposure duration	yr	7	[3]	2	[3]	24	[3]	6	[3]
	Averaging Time, Cancer	yr	70	[2]	70	[2]	70	[2]	70	[2]
	Averaging Time, Noncancer	yr	9	[2]	9	[2]	30	[2]	30	[2]
Ingestion of Groundwater (as drinking water)	Ingestion rate	L/d	1.4	[1, 2, 3]	0.7	[a]	2.0	[1, 2, 3]	1	[a]

CTE = Central Tendency Exposure
RME = Reasonable Maximum Exposure

Sources:

[1] USEPA 1991. Human Health Evaluation Manual, Supplemental Guidance: Standard Default Exposure Factors. OSWER Directive 9285.6-03. March.
[2] USEPA 1989. Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Part A). Office of Emergency and Remedial Response, Washington, D.C. EPA/540/1-89/002. December.
[3] USEPA 1993. Superfund's Standard Default Exposure Factors for the Central Tendency and Reasonable Maximum Exposure.
[4] USEPA 1997. Exposure Factors Handbook.
[5] Professional judgment.
[6] Jefferson County, Colorado Open Space 1996. Jefferson County Open Space Trail Usage Survey. Golden, CO.
[7] USEPA 1998. Draft Water Quality Criteria Methodology Revisions.

[8] SAF. 2000. Final. Remedial Investigation Report. Zone A. Operable Unit 3: Landfill 6. Volume 3. Appendix K. Baseline Risk Assessment May 15. (FE Warren Site).
[9] USEPA 2004. Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment). OSWER 9285.7-02EP. July.

Notes:

[a] Assumes exposure is same as for resident.
[b] Assumes exposure frequency is same as low-intensity recreational visitor.
[c] From Section 10.10.3, recommendations for recreational freshwater anglers. RME is equivalent ot 58 meals/year and CTE is equivalent to 19 meals/year (15(g/meal).
[d] assumes 10% and 20% of fish consumed annually are frcm the Gilt Edge Site/areas impacted by the Gilt Edge Site.
[e] Assumes CTE ingestion rate is half of the RME ingestion rate.
[f] Assumes RME sediment ingestion is same as CTE soil ingestion.
[g] 30 mL/hr is the basis for the 10 mL/day value proposed for a recreational scenario by the Draft Water Quality Criteria Methodology Revisions (USEPA 1998).
[h] Incidental ingestion from splashing or hand-to-face contact during wading assumed to be 10% of USEPA (1989) recommended default (50 ml/hr) incidentally ingested during swimming.
[i] Default for inorganic chemicals.
[j] Assumes exposure of hands, forearms, lower legs, and feet. Average of male and females. (USEPA 1997, Tables 6-2 and 6-3).
[k] Assumes soil and sediment adherence factors are two times that of USEPA 2004 (Exhibit 3-5) recommended soil adherence factors for a resident.

Table 3-11. Summary of Human Intake Factor (HIF) Values

Site Area	Receptor	Exposure Route	HIF (mg/kg-day)			
			Non-Cancer		Cancer	
			CTE	RME	CTE	RME
Mine Facility (On-Site)	Residents	Ingestion of Surface Soil	1.31E-06	3.65E-06	1.68E-07	1.57E-06
		Ingestion of Ground Water	1.66E-02	3.47E-02	2.14E-03	1.49E-02
	Construction Worker	Air Inhalation	1.65E-01	1.88E-01	1.18E-03	2.68E-03
		Ingestion of Soil	1.41E-06	3.23E-06	1.01E-08	4.61E-08
	Commercial Worker	Ingestion of Surface Soil	2.14E-07	4.89E-07	1.53E-08	1.75E-07
		Ingestion of Ground Water	6.00E-03	9.78E-03	4.29E-04	3.49E-03
	Hiker	Ingestion of Surface Soil	5.44E-08	5.22E-07	7.00E-09	2.24E-07
		Ingestion of Sediment	2.72E-08	2.61E-07	3.50E-09	1.12E-07
		Ingestion of Surface Water	3.46E-06	3.05E-04	4.45E-07	1.31E-04
	ATV Rider	Air Inhalation	2.75E-03	2.35E-02	3.53E-04	1.01E-02
		Ingestion of Surface Soil	3.82E-08	3.91E-07	4.91E-09	1.68E-07
Riparian Area (Off-Site)	Recreational Fishermen (Adult)	Ingestion of Fish	6.11E-07	9.78E-06	6.11E-08	3.35E-06
		Ingestion of Sediment	9.54E-10	9.78E-09	9.54E-11	3.35E-09
		Ingestion of Surface Water	1.91E-07	1.76E-05	1.91E-08	6.04E-06
	Residential Child	Ingestion of Sediment	9.13E-08	3.65E-07	2.61E-09	3.13E-08
		Ingestion of Surface Water	9.13E-06	3.29E-04	2.61E-07	2.82E-05
	Resident (Lifetime)	Ingestion of Ground Water	1.66E-02	3.47E-02	2.14E-03	1.49E-02

Table 3-12. Adult Lead Model Inputs

Parameter	Unit	On-Site Receptors			Off-Site Receptors		Source	Basis
		ATV Rider	Commercial Worker	Construction Worker	Recreational Fisherman	Residential Child (7-12 years)		
PbB0	ug/dL	1.7	1.7	1.7	1.7	1.7	AGEISS 1996	Bingham Creek Study
BKSF	ug/dL per ug/day	0.4	0.4	0.4	0.4	0.4	USEPA 2003a	USEPA default recommendation.
IR_{soil}	mg/day	50	25	165	--	--	USEPA 2002a	CTE exposure parameter
EF_{soil}	days/yr	19.5	219	219	--	--	USEPA 1993 and Professional Judgement	CTE exposure parameter
BR_{air}	m3/day	3.6	--	19.2	--	--	USEPA 1997	CTE exposure parameter
$IR_{groundwater}$	L/day	--	0.7	--	--	--	USEPA 1997 and Professional Judgement	CTE exposure parameter. Assumes worker ingestion rate is half of residential ingestion rate
$EF_{groundwater}$	days/yr	--	219	--	--	--	USEPA 1993	CTE exposure parameter
EF_{air}	days/yr	19.5	--	219	--	--	USEPA 2002a and Professional Judgement	CTE exposure parameter
$IR_{sediment}$	mg/day	--	--	--	12.5	25	Professional Judgement	CTE exposure parameter
$IR_{surface\ water}$	L/day	--	--	--	0.0025	0.0025	Professional Judgement	CTE exposure parameter. Assumes 5 mL/hour; 0.5 hours/day.
$EF_{sediment/surface\ water}$	days/yr	--	--	--	1.9	44	Professional Judgement	CTE exposure parameter
PEF	kg/m^3	1.18E-06	--	2.86E-08	--	--	USEPA 1996 and professional judgement	Appendix E
AF	(unitless)	0.12	0.12	0.12	0.12	0.12	USEPA 2003a	USEPA default recommendation.
$Ratio_{fetal/maternal}$	(unitless)	0.9	0.9	0.9	0.9	0.9	USEPA 2003a	USEPA default recommendation.
GSD	(unitless)	1.5	1.5	1.5	1.5	1.5	AGEISS 1996	Bingham Creek Study

-- = Model input not applicable to this receptor.
AGEISS 1996.
USEPA 1993. Superfund's standard Default Exposure Factors for the CTE and RME.
USEPA 1997. Exposure Factors Handbook
USEPA 2002a. Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites.
USEPA 2003a. Recommendations of the Technical Review Workgroup for Lead - an approach for assessing risks associated with adult exposure to lead in soil.

Table 3-13 IEUBK Model Inputs

CONCENTRATION OF SOIL AND INDOOR DUST

C_{soil} (on-site) = Mean soil concentration at an exposure unit
C_{soil} (off-site) = Mean soil concentration associated with a baseline blood lead level of 2.7 ug/dL
C_{dust} (on-site and off-site) = $0.43*C_{soil}$ (based on Binhgam Creek)

CONSTANT MODEL INPUTS

PARAMETER	VALUE
Air concentration (ug/m3)	0.10
Indoor air concentration	30% of outdoors
Drinking water concentration (ug/L)	4.0
Absorption Fractions: Air Diet Water Soil/Dust	 32% 50% 50% 30%
Fraction soil	45%
GSD [1]	1.4

AGE DEPENDENT MODEL INPUTS

	AIR		DIET	WATER	SOIL
Age	Time Outdoors (hrs)	Ventilation Rate (m3/day)	Dietary Intake [2] (ug/day)	Intake (L/day)	Intake (mg/day)
0-1	1.0	2.0	3.16	0.20	85
1-2	2.0	3.0	2.6	0.50	135
2-3	3.0	5.0	2.87	0.52	135
3-4	4.0	5.0	2.74	0.53	135
4-5	4.0	5.0	2.61	0.55	100
5-6	4.0	7.0	2.74	0.58	90
6-7	4.0	7.0	2.99	0.59	85

[1] Based on Griffin et al. (1999)
[2] Revised USEPA recommended dietary intake parameters, based updated dietary lead intake estimates from the Food and Drug Administration Total Diet Study (FDA 2001) and food consumption data from NHANES III (CDC 1997) .

Table 3-14. On-Site Exposure Units

Media	Exposure Unit ID	Exposure Unit Description	Corresponding Soil Exposure Unit
Surface Soil	AH&P	Anchor Hill and Ponds	--
	HLP	Heap Leach Pad	--
	LP	Langley Pit	--
	PCA	Pits and Crusher Area	--
	RGWRD	Ruby Gulch Waste Rock Repository	--
Surface and Subsurface Soil (combined)	AH&P	Anchor Hill and Ponds	--
	HLP	Heap Leach Pad	--
	LP	Langley Pit	--
	PCA	Pits and Crusher Area	--
	RGWRD	Ruby Gulch Waste Rock Repository	--
Groundwater	BED-8	Well BED-8	AH&P
	CDM01b	Well CDM01b	PCA
	CDM02	Well CDM02	PCA
	CDM03b	Well CDM03b	PCA
	CDM04b	Well CDM04b	PCA
	GE-MW-06	Well GE-MW-06	LP
	GE-MW-07	Well GE-MW-07	PCA
	GE-MW-08	Well GE-MW-08	AH&P
	GE-MW-15	Well GE-MW-15	PCA
	GE-MW-16	Well GE-MW-16	PCA
	GE-MW-17	Well GE-MW-17	PCA
	GW-10A	Well GW-10A	RGWRD
	GW-8	Well GW-8	RGWRD
	GWCDM11	Well GWCDM11	PCA
	GWCDM12	Well GWCDM12	PCA
Surface Water	AHPL	Anchor Hill Pit Lake	AH&P
	BKD2	Background2	AH&P
	DMPL	Dakota Maid Pit Lake	PCA
	HLP	Heap Leach Pad	HLP
	LA	Langley Adit	PCA
	LCPD	Last Chance Pond	PCA
	PDC	Pond C	PCA
	PDD	Pond-D	PCA
	PDE	Pond E	PCA
	RGT	Ruby Gulch Tributary	RGWRD
	RPD	Ruby Pond	RGWRD
	RRB	Base of Ruby Repository	RGWRD
	SC1	Strawberry Creek above Confluence with Cabin Creek	PCA
	SCHW	Strawberry Creek Headwaters	AH&P
	SGPD	Surge Pond	AH&P
	SPL	Sunday Pit Lake	PCA
	SWPD	Stormwater Pond	AH&P
Sediment	AHPL	Anchor Hill Pit Lake	AH&P
	BKD2	Background2	AH&P
	BKD3	Background3	AH&P
	DMPL	Dakota Maid Pit Lake	PCA
	HLP	Heap Leach Pad	HLP
	LA	Langley Adit	PCA
	PDC	Pond C	PCA
	PDD	Pond-D	PCA
	RGT	Ruby Gulch Tributary	RGWRD
	SC1	Strawberry Creek above Confluence with Cabin Creek	PCA
	SCHW	Strawberry Creek Headwaters	AH&P
	SPL	Sunday Pit Lake	PCA

Table 3-15. Off-Site Exposure Units

Media	Exposure Unit ID	Exposure Unit Description
Groundwater	BED11	Well BED11
	BED-14	Well BED-14
	BED-19	Well BED-19
	BED-7	Well BED-7
	BES-11	Well BES-11
	BES-14	Well BES-14
	BES-17	Well BES-17
	CDM06b	Well CDM06b
	GE-MW-18	Well GE-MW-18
	GE-MW-19	Well GE-MW-19
	GW-6	Well GW-6
	GW-7	Well GW-7
	GW-8A	Well GW-8A
	GW-9A	Well GW-9A
	GWCDM09	Well GWCDM09
	GWCDM10	Well GWCDM10
	GWCDM14	Well GWCDM14
Surface Water	BBC0	Bear Butte Creek upstream of confluence with Strawberry Creek
	BBC1	Bear Butte Creek btwn Strawbeery Creek and Terrible Gulch
	BBC2	Bear Butte Creek btwn Terrible Gulch and Ruby Gulch
	BBC3	Bear Butte Creek btwn Ruby Gulch and Butcher Gulch
	BBC4	Bear Butte Creek downstream of Butcher Gulch
	BHG	Butcher Gulch
	BKD1	Background1
	BMG	Boomer Gulch
	CC	Cabin Creek
	HG	Hoodo Gulch
	OFA	Oro Fino Adit
	RG	Ruby Gulch
	SC2	Strawberry Creek btwn Cabin Creek and Hoodo Gulch
	SC3	Strawbeery Creek btwn Hoodo Gulch and Boomer Gulch
	SC4	Strawberry Creek btwn Boomer Gulch and Bear Butte Creek
	TG	Terrible Gulch
Sediment	BBC0	Bear Butte Creek upstream of confluence with Strawberry Creek
	BBC1	Bear Butte Creek btwn Strawbeery Creek and Terrible Gulch
	BBC2	Bear Butte Creek btwn Terrible Gulch and Ruby Gulch
	BBC3	Bear Butte Creek btwn Ruby Gulch and Butcher Gulch
	BBC4	Bear Butte Creek downstream of Butcher Gulch
	BHG	Butcher Gulch
	BKD1	Background1
	BMG	Boomer Gulch
	CC	Cabin Creek
	HG	Hoodo Gulch
	OFA	Oro Fino Adit
	RG	Ruby Gulch
	SC2	Strawberry Creek btwn Cabin Creek and Hoodo Gulch
	SC3	Strawbeery Creek btwn Hoodo Gulch and Boomer Gulch
	SC4	Strawberry Creek btwn Boomer Gulch and Bear Butte Creek
	TG	Terrible Gulch
Fish Tissue	BBC0	Bear Butte Creek upstream of confluence with Strawberry Creek
	BBC1	Bear Butte Creek btwn Strawbeery Creek and Terrible Gulch
	BBC2	Bear Butte Creek btwn Terrible Gulch and Ruby Gulch
	BBC3	Bear Butte Creek btwn Ruby Gulch and Butcher Gulch
	BBC4	Bear Butte Creek downstream of Butcher Gulch
	BMG	Boomer Gulch
	SC2	Strawberry Creek btwn Cabin Creek and Hoodo Gulch
	SC4	Strawberry Creek btwn Boomer Gulch and Bear Butte Creek

Table 4-1. Human Health Toxicity Values

CHEMICAL	CAS	Note	INGESTION Oral SF (mg/kg-day)-1	Source	Oral RfD mg/kg-day	Source	INHALATION Inhalation SF (mg/kg-day)-1	Source	Inhalation RfD mg/kg-day	Source
Aluminum	7429905	[1]	–	–	1.0E+00	P [2]	–	–	1.0E-03	P [2]
Ammonia	7664417		–	–	–	–	–	–	2.9E-02	I
Antimony	7440360		–	–	4.0E-04	I	–	–	–	–
Arsenic	7440382		1.5E+00	I	3.0E-04	I	1.5E+01	I	–	–
Beryllium	7440417		–	–	2.0E-03	I	8.4E+00	I	5.7E-06	I
Cadmium-food	7440439		–	–	1.0E-03	I	6.3E+00	I	5.7E-05	E [2]
Cadmium-water	7440439		–	–	5.0E-04	I	6.3E+00	I	5.7E-05	E [2]
Chromium III	16065831		–	–	1.5E+00	I	–	–	–	–
Chromium VI	18540299		–	–	3.0E-03	I	4.1E+01	I	3.0E-05	I
Cobalt	7440484	[2]	–	–	2.0E-02	P [2]	9.8E+00	P [2]	5.7E-06	P [2]
Copper	7440508		–	–	4.0E-02	H [1]	–	–	–	–
Cyanide	57125	[3]	–	–	2.0E-02	I	–	–	–	–
Iron	7439896		–	–	3.0E-01	E [1]	–	–	–	–
Lithium	7439932		–	–	2.0E-02	E [1]	–	–	–	–
Manganese-food	7439965		–	–	4.7E-02	I [4]	–	–	1.4E-05	I
Manganese-nonfood	7439965		–	–	2.0E-02	I	–	–	1.4E-05	I
Mercury	7487947	[5]	–	–	3.0E-04	I	–	–	–	–
Mercury-fish tissue		[6]	–	–	1.0E-04	I	–	–	–	–
Molybdenum	7439987		–	–	5.0E-03	I	–	–	–	–
Nickel	7440020		–	–	2.0E-02	I	–	–	–	–
Nitrate	14797558		–	–	1.6E+00	I	–	–	–	–
Nitrite	14797650		–	–	1.0E-01	I	–	–	–	–
Selenium	7782492		–	–	5.0E-03	I	–	–	–	–
Silver	7440224		–	–	5.0E-03	I	–	–	–	–
Strontium	7440246		–	–	6.0E-01	I	–	–	–	–
Thallium	7440280		–	–	7.0E-05	O [1]	–	–	–	–
Vanadium	7440622		–	–	1.0E-03	E [1]	–	–	–	–
Zinc	7440666		–	–	3.0E-01	I	–	–	–	–

CSF = Cancer Slope Factor
RfC = Noncancer Reference Concentration
RfD = Noncancer Reference Dose
UR = Unit Risk

I = IRIS
H = HEAST
E = EPA-NCEA Provisional Value
O = Other
P = EPA Provisional Peer-Reviewed Value
– = A USEPA Recommended toxicity value is not available for this chemical

Notes:

[1] As cited in Region III Tables (10/2005 update): http://www.epa.gov/reg3hwmd/risk/human/index.htm, accessed February, 2006.

[2] As cited in Region III Tables (4/2005 update)

[3] Toxicity data for chromium VI (more conservative of chromium III and chromium VI RfD_o).

[3] Toxicity data for free cyanide

[4] RfDo (1.4E-01 mg/kg-day) adjusted by a modifying factor of 3, in accord with IRIS and USEPA Region 8 recommendations.

[5] Toxicity data for mercuric chloride.

[6] Methylmercury

Table 5-1
Risks to On-Site Receptors from Incidental Ingestion and Inhalation of On-Site Soils

Repeptor and Pathway	Exposure Unit	HI		Cancer Risk		P10 % (Lead)
		CTE	RME	CTE	RME	
Recreational Visitors (ingestion only)	AH&P	4E-01	4E+00	1E-06	4E-05	<0.1
	HLP	2E-01	1E+00	3E-06	1E-04	<0.1
	LP	7E-01	7E+00	4E-06	1E-04	<0.1
	PCA	2E-01	2E+00	9E-07	3E-05	<0.1
	RGWRD	2E-02	2E-01	6E-07	2E-05	<0.1
ATV Riders (ingestion and inhalation)	AH&P	1E+00	1E+01	2E-06	5E-05	<0.1
	HLP	3E-01	3E+00	4E-06	1E-04	<0.1
	LP	8E-01	8E+00	6E-06	2E-04	<0.1
	PCA	3E-01	3E+00	2E-06	5E-05	<0.1
	RGWRD	3E-01	2E+00	8E-07	3E-05	<0.1
Construction Workers (ingestion and inhalation)	AH&P	8E+00	2E+01	1E-06	6E-06	<0.1
	HLP	4E+00	9E+00	5E-06	2E-05	0.40
	LP	2E+01	5E+01	1E-05	5E-05	1.1
	PCA	4E+00	8E+00	1E-06	6E-06	<0.1
	RGWRD	1E+01	3E+01	1E-06	5E-06	<0.1
Commercial Workers (ingestion only)	AH&P	2E+00	4E+00	3E-06	3E-05	<0.1
	HLP	6E-01	1E+00	7E-06	8E-05	<0.1
	LP	3E+00	6E+00	9E-06	1E-04	<0.1
	PCA	7E-01	1E+00	2E-06	2E-05	<0.1
	RGWRD	8E-02	2E-01	1E-06	2E-05	<0.1
Residents (ingestion only)	AH&P	1E+01	3E+01	3E-05	3E-04	<0.1
	HLP	4E+00	1E+01	7E-05	7E-04	0.50
	LP	2E+01	5E+01	1E-04	1E-03	7.68
	PCA	4E+00	1E+01	2E-05	2E-04	<0.1
	RGWRD	5E-01	1E+00	2E-05	1E-04	<0.1

Shaded cells indicate locations where noncancer risks exceed an HI of 1E+00 , a cancer risk of 1E-04, or a P10 value of 5%.

Table 5-2
Risks to Hikers from On-Site Surface Water
and Sediment

Panel A: Surface Water (Total Metals)

Location	HI		Cancer Risk		P10% (Lead)
	CTE	RME	CTE	RME	
AHPL	8E-03	7E-01	9E-09	3E-06	<0.1
BKD2	2E-04	2E-02	2E-09	6E-07	<0.1
DMPL	7E-02	6E+00	2E-06	6E-04	<0.1
HLP	1E-02	1E+00	3E-07	1E-04	<0.1
LA	1E-02	1E+00	5E-07	1E-04	<0.1
LCPD	7E-03	6E-01	1E-08	4E-06	<0.1
PDC	1E-03	1E-01	2E-09	6E-07	<0.1
PDD	4E-02	3E+00	6E-07	2E-04	<0.1
PDE	4E-02	4E+00	5E-07	1E-04	<0.1
RGT	1E-04	1E-02	1E-09	4E-07	<0.1
RPD	8E-02	7E+00	2E-06	6E-04	<0.1
RRB	1E-01	9E+00	3E-06	9E-04	<0.1
SC1	3E-02	2E+00	7E-07	2E-04	<0.1
SCHW	2E-04	2E-02	1E-09	4E-07	<0.1
SGPD	7E-03	6E-01	2E-08	5E-06	<0.1
SPL	4E-02	3E+00	8E-07	2E-04	<0.1
SWPD	7E-03	6E-01	1E-08	4E-06	<0.1

Panel B: Sediment

Location	HI		Cancer Risk		P10% (Lead)
	CTE	RME	CTE	RME	
AHPL	6E-02	6E-01	4E-07	1E-05	<0.1
BKD2	5E-03	5E-02	1E-07	3E-06	<0.1
BKD3	1E-02	1E-01	3E-07	9E-06	<0.1
DMPL	1E-01	1E+00	6E-06	2E-04	<0.1
HLP	2E-02	2E-01	3E-07	9E-06	<0.1
LA	5E-02	5E-01	3E-06	8E-05	<0.1
PDC	1E-02	1E-01	3E-07	1E-05	<0.1
PDD	8E-02	7E-01	4E-06	1E-04	<0.1
RGT	1E-02	1E-01	5E-07	1E-05	<0.1
SC1	4E-02	4E-01	1E-06	3E-05	<0.1
SCHW	7E-03	6E-02	1E-07	4E-06	<0.1
SPL	1E-01	1E+00	6E-06	2E-04	<0.1

Shaded cells indicate locations where noncancer risks exceed an HI of 1E+00 , a cancer risk of 1E-04, or a P10 value of 5%.

Table 5-3
Risks to Hypothetical Future Residents from Ingestion of On-Site Groundwater

Panel A: Dissolved Metals

Well	HI		Cancer Risk		P10 (%) (lead)
	CTE	RME	CTE	RME	
BED-8	6E+00	1E+01	2E-05	2E-04	<0.1
CDM01b	6E+00	1E+01	2E-05	2E-04	<0.1
CDM02	3E+01	7E+01	2E-05	2E-04	<0.1
CDM03b	4E+02	7E+02	2E-03	1E-02	79
CDM04b	7E+00	2E+01	3E-04	2E-03	65
GE-MW-06	2E+01	4E+01	1E-04	1E-03	57
GE-MW-07	1E+01	3E+01	3E-05	2E-04	<0.1
GE-MW-08	1E+02	3E+02	5E-04	4E-03	100
GE-MW-15	5E+01	1E+02	2E-05	1E-04	1.3
GE-MW-16	5E+01	1E+02	8E-05	5E-04	<0.1
GE-MW-17	3E+01	7E+01	8E-06	6E-05	1.4
GW-10A	2E+00	3E+00	2E-05	2E-04	<0.1
GW-8	3E+01	6E+01	5E-05	4E-04	<0.1
GWCDM11	5E+00	1E+01	2E-05	2E-04	<0.1
GWCDM12	1E+01	3E+01	2E-05	2E-04	<0.1

Panel B: Total Metals

Well	HI		Cancer Risk		P10 (%) (lead)
	CTE	RME	CTE	RME	
BED-8	6E+00	1E+01	2E-05	2E-04	<0.1
CDM01b	8E+00	2E+01	4E-05	3E-04	<0.1
CDM02	3E+01	6E+01	3E-05	2E-04	<0.1
CDM03b	4E+02	8E+02	3E-03	2E-02	89
CDM04b	3E+01	7E+01	1E-03	9E-03	100
GE-MW-06	2E+01	4E+01	2E-04	1E-03	63
GE-MW-07	1E+01	3E+01	3E-05	2E-04	<0.1
GE-MW-08	1E+02	3E+02	6E-04	4E-03	100
GE-MW-15	4E+01	8E+01	--	--	1
GE-MW-16	6E+01	1E+02	1E-04	8E-04	1
GE-MW-17	3E+01	7E+01	8E-06	6E-05	2
GW-10A	2E+00	4E+00	3E-05	2E-04	10
GW-8	3E+01	6E+01	1E-04	8E-04	<0.1
GWCDM11	1E+01	3E+01	5E-05	4E-04	<0.1
GWCDM12	1E+01	3E+01	5E-05	3E-04	<0.1

-- Arsenic not measured in groundwater samples at this well, thus cancer risk estimates are not available at this location.

Shaded cells indicate locations where noncancer risks exceed an HI of 1E+00, a cancer risk of 1E-04, or a P10 value of 5%.

Table 5-4

Risks to Hypothetical Future Commercial Workers from Ingestion of On-Site Groundwater

Panel A: Dissolved Metals

Well	HI		Cancer Risk		$P10_{fetus}$ (%) (lead)
	CTE	RME	CTE	RME	
BED-8	2E+00	4E+00	5E-06	4E-05	<0.1
CDM01b	2E+00	4E+00	5E-06	4E-05	<0.1
CDM02	1E+01	2E+01	5E-06	4E-05	<0.1
CDM03b	1E+02	2E+02	3E-04	3E-03	3
CDM04b	3E+00	4E+00	5E-05	4E-04	1.4
GE-MW-06	7E+00	1E+01	3E-05	2E-04	0.5
GE-MW-07	5E+00	8E+00	6E-06	5E-05	<0.1
GE-MW-08	5E+01	8E+01	1E-04	9E-04	77
GE-MW-15	2E+01	3E+01	4E-06	3E-05	<0.1
GE-MW-16	2E+01	3E+01	2E-05	1E-04	<0.1
GE-MW-17	1E+01	2E+01	2E-06	1E-05	<0.1
GW-10A	6E-01	1E+00	4E-06	4E-05	<0.1
GW-8	1E+01	2E+01	1E-05	8E-05	<0.1
GWCDM11	2E+00	3E+00	5E-06	4E-05	<0.1
GWCDM12	5E+00	9E+00	5E-06	4E-05	<0.1

Panel B: Total Metals

Well	HI		Cancer Risk		$P10_{fetus}$ (%) (lead)
	CTE	RME	CTE	RME	
BED-8	2E+00	4E+00	5E-06	4E-05	<0.1
CDM01b	3E+00	5E+00	8E-06	7E-05	<0.1
CDM02	1E+01	2E+01	6E-06	5E-05	<0.1
CDM03b	1E+02	2E+02	5E-04	4E-03	6
CDM04b	1E+01	2E+01	3E-04	2E-03	86
GE-MW-06	7E+00	1E+01	3E-05	3E-04	0.8
GE-MW-07	5E+00	8E+00	5E-06	4E-05	<0.1
GE-MW-08	5E+01	8E+01	1E-04	9E-04	81
GE-MW-15	1E+01	2E+01	--	--	<0.1
GE-MW-16	2E+01	3E+01	2E-05	2E-04	<0.1
GE-MW-17	1E+01	2E+01	2E-06	1E-05	<0.1
GW-10A	7E-01	1E+00	6E-06	5E-05	<0.1
GW-8	1E+01	2E+01	2E-05	2E-04	<0.1
GWCDM11	5E+00	7E+00	1E-05	8E-05	<0.1
GWCDM12	5E+00	8E+00	1E-05	8E-05	<0.1

-- Arsenic not measured in groundwater samples at this well, thus cancer risk estimates are not available at this location.

Shaded cells indicate locations where noncancer risks exceed an HI of 1E+00, a cancer risk of 1E-04, or a P10 value of 5%.

Table 5-4

Risks to Hypothetical Future Commercial Workers from Ingestion of On-Site Groundwater

Panel A: Dissolved Metals

Well	HI		Cancer Risk		$P10_{fetus}$ (%)
	CTE	RME	CTE	RME	(lead)
BED-8	2E+00	4E+00	5E-06	4E-05	<0.1
CDM01b	2E+00	4E+00	5E-06	4E-05	<0.1
CDM02	1E+01	2E+01	5E-06	4E-05	<0.1
CDM03b	1E+02	2E+02	3E-04	3E-03	3
CDM04b	3E+00	4E+00	5E-05	4E-04	1.4
GE-MW-06	7E+00	1E+01	3E-05	2E-04	0.5
GE-MW-07	5E+00	8E+00	6E-06	5E-05	<0.1
GE-MW-08	5E+01	8E+01	1E-04	9E-04	77
GE-MW-15	2E+01	3E+01	4E-06	3E-05	<0.1
GE-MW-16	2E+01	3E+01	2E-05	1E-04	<0.1
GE-MW-17	1E+01	2E+01	2E-06	1E-05	<0.1
GW-10A	6E-01	1E+00	4E-06	4E-05	<0.1
GW-8	1E+01	2E+01	1E-05	8E-05	<0.1
GWCDM11	2E+00	3E+00	5E-06	4E-05	<0.1
GWCDM12	5E+00	9E+00	5E-06	4E-05	<0.1

Panel B: Total Metals

Well	HI		Cancer Risk		$P10_{fetus}$ (%)
	CTE	RME	CTE	RME	(lead)
BED-8	2E+00	4E+00	5E-06	4E-05	<0.1
CDM01b	3E+00	5E+00	8E-06	7E-05	<0.1
CDM02	1E+01	2E+01	6E-06	5E-05	<0.1
CDM03b	1E+02	2E+02	5E-04	4E-03	6
CDM04b	1E+01	2E+01	3E-04	2E-03	86
GE-MW-06	7E+00	1E+01	3E-05	3E-04	0.8
GE-MW-07	5E+00	8E+00	5E-06	4E-05	<0.1
GE-MW-08	5E+01	8E+01	1E-04	9E-04	81
GE-MW-15	1E+01	2E+01	--	--	<0.1
GE-MW-16	2E+01	3E+01	2E-05	2E-04	<0.1
GE-MW-17	1E+01	2E+01	2E-06	1E-05	<0.1
GW-10A	7E-01	1E+00	6E-06	5E-05	<0.1
GW-8	1E+01	2E+01	2E-05	2E-04	<0.1
GWCDM11	5E+00	7E+00	1E-05	8E-05	<0.1
GWCDM12	5E+00	8E+00	1E-05	8E-05	<0.1

-- Arsenic not measured in groundwater samples at this well, thus cancer risk estimates are not available at this location.

Shaded cells indicate locations where noncancer risks exceed an HI of 1E+00, a cancer risk of 1E-04, or a P10 value of 5%.

Table 5-6
Risks to Recreational Fisherman from Surface Water and Sediment in Off-Site Drainages

Panel A: Surface Water (Total Metals)

Reach	HI		Cancer Risk		$P10_{fetus}$ (%) (lead)
	CTE	RME	CTE	RME	
BBC0	1E-05	1E-03	1E-10	4E-08	< 0.1
BBC1	2E-05	1E-03	7E-11	2E-08	< 0.1
BBC2	1E-05	1E-03	1E-10	4E-08	< 0.1
BBC3	2E-05	2E-03	1E-10	3E-08	< 0.1
BBC4	1E-05	1E-03	7E-11	2E-08	< 0.1
BHG	1E-05	1E-03	2E-10	6E-08	< 0.1
BKD1	9E-06	8E-04	9E-11	3E-08	< 0.1
BMG	8E-06	8E-04	5E-11	2E-08	< 0.1
CC	2E-05	2E-03	2E-10	7E-08	< 0.1
HG	2E-04	2E-02	2E-09	5E-07	< 0.1
OFA	3E-05	3E-03	2E-10	5E-08	< 0.1
RG	5E-04	4E-02	1E-10	5E-08	< 0.1
SC2	2E-05	2E-03	5E-11	2E-08	< 0.1
SC3	2E-05	2E-03	6E-11	2E-08	< 0.1
SC4	1E-05	1E-03	7E-11	2E-08	< 0.1
TG	1E-05	1E-03	7E-11	2E-08	< 0.1

Panel B: Sediment

Reach	HI		Cancer Risk		$P10_{fetus}$ (%) (lead)
	CTE	RME	CTE	RME	
BBC0	6E-04	6E-03	1E-08	5E-07	< 0.1
BBC1	7E-04	7E-03	2E-08	6E-07	< 0.1
BBC2	6E-04	6E-03	1E-08	4E-07	< 0.1
BBC3	1E-03	1E-02	3E-08	1E-06	< 0.1
BBC4	1E-03	2E-02	5E-08	2E-06	< 0.1
BHG	2E-04	2E-03	2E-09	8E-08	< 0.1
BKD1	3E-04	3E-03	9E-09	3E-07	< 0.1
BMG	4E-04	4E-03	2E-09	7E-08	< 0.1
CC	3E-04	3E-03	3E-09	1E-07	< 0.1
HG	1E-03	1E-02	3E-08	9E-07	< 0.1
OFA	2E-03	2E-02	3E-08	1E-06	< 0.1
RG	7E-04	7E-03	2E-08	7E-07	< 0.1
SC2	9E-04	9E-03	2E-08	6E-07	< 0.1
SC3	8E-04	8E-03	2E-08	6E-07	< 0.1
SC4	1E-03	1E-02	2E-08	8E-07	< 0.1
TG	2E-04	2E-03	8E-10	3E-08	< 0.1

Shaded cells indicate locations where noncancer risks exceed an HI of 1E+00 , a cancer risk of 1E-04, or a P10 value of 5%.

Table 5-7
Risks to Fisherman from Ingestion of Fish
from Off-Site Drainages

Reach	HI		Cancer Risk	
	CTE	RME	CTE	RME
BBC0	3E-03	5E-02	7E-08	4E-06
BBC1	5E-03	8E-02	1E-07	5E-06
BBC2	4E-03	7E-02	8E-08	5E-06
BBC3	6E-03	9E-02	9E-08	5E-06
BBC4	8E-03	1E-01	9E-08	5E-06
BMG	2E-03	3E-02	4E-08	2E-06
SC2	4E-03	6E-02	9E-08	5E-06
SC4	4E-03	7E-02	9E-08	5E-06

Table 5-8
Risks to Residents from Ingestion of Groundwater
Along Off-Site Drainages

Panel A: Dissolved Metals

Well	HI		Cancer Risk		P10 % (lead)
	CTE	RME	CTE	RME	
BED11	7E+00	2E+01	2E-05	2E-04	<0.1
BED-14	5E+00	1E+01	2E-05	2E-04	<0.1
BED-19	1E-01	2E-01	--	--	2
BED-7	5E+00	1E+01	4E-05	3E-04	<0.1
BES-11	5E+00	1E+01	3E-05	2E-04	<0.1
BES-14	5E+00	1E+01	2E-05	2E-04	<0.1
BES-17	8E+00	2E+01	1E-04	8E-04	<0.1
CDM06b	4E-01	9E-01	--	--	<0.1
GE-MW-18	7E-01	1E+00	8E-06	6E-05	<0.1
GE-MW-19	3E-01	5E-01	8E-06	6E-05	<0.1
GW-6	2E+01	4E+01	2E-05	2E-04	<0.1
GW-7	1E+01	3E+01	3E-05	2E-04	<0.1
GW-8A	6E+00	1E+01	3E-05	2E-04	<0.1
GW-9A	6E+00	1E+01	4E-05	3E-04	<0.1
GWCDM09	1E+01	3E+01	3E-05	2E-04	<0.1
GWCDM10	1E+01	3E+01	2E-05	2E-04	<0.1
GWCDM14	3E+01	7E+01	8E-05	6E-04	<0.1

Panel B: Total Metals

Well	HI		Cancer Risk		P10 % (lead)
	CTE	RME	CTE	RME	
BED11	7E+00	2E+01	2E-05	2E-04	<0.1
BED-14	6E+00	1E+01	2E-05	2E-04	<0.1
BED-19	3E-01	6E-01	--	--	12
BED-7	5E+00	1E+01	4E-05	3E-04	<0.1
BES-11	1E+01	2E+01	3E-04	2E-03	0.4
BES-14	6E+00	1E+01	2E-05	2E-04	<0.1
BES-17	2E+01	4E+01	9E-04	6E-03	<0.1
CDM06b	4E-01	9E-01	--	--	<0.1
GE-MW-18	4E+00	9E+00	2E-05	2E-04	1.6
GE-MW-19	5E-01	1E+00	8E-06	6E-05	<0.1
GW-6	1E+01	3E+01	6E-05	4E-04	<0.1
GW-7	2E+01	3E+01	2E-05	2E-04	<0.1
GW-8A	1E+01	2E+01	4E-05	3E-04	4.3
GW-9A	6E+00	1E+01	4E-05	3E-04	<0.1
GWCDM09	2E+01	3E+01	4E-05	3E-04	<0.1
GWCDM10	1E+01	3E+01	2E-05	2E-04	<0.1
GWCDM14	4E+01	8E+01	1E-04	1E-03	<0.1

-- Arsenic not measured in groundwater samples at this well, thus cancer risk estimates are not available at this location.

Shaded cells indicate locations where noncancer risks exceed an HI of 1E+00, a cancer risk of 1E-04, or a P10 value of 5%.

Table 5-9
Total Risks to Hikers from On-Site Surface Water, Sediment, and Soil

Exposure Units		Non-Cancer HI								Cancer Risk								$P10_{child}$ (%) (lead)
Surface Water & Sediment	Soil	Surface Water		Sediment		Soil		Total		Surface Water		Sediment		Soil		Total		
		CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	
AHPL	AH&P	8E-03	7E-01	6E-02	6E-01	4E-01	4E+00	5E-01	4E+00	9E-09	3E-06	4E-07	1E-05	1E-06	4E-05	2E-06	4E-05	<0.1
BKD2	AH&P	2E-04	2E-02	5E-03	5E-02	4E-01	4E+00	4E-01	4E+00	2E-09	6E-07	1E-07	3E-06	1E-06	4E-05	1E-06	4E-05	<0.1
BKD3	AH&P	--	--	1E-02	1E-01	4E-01	4E+00	4E-01	4E+00	--	--	3E-07	9E-06	1E-06	4E-05	1E-06	4E-05	<0.1
DMPL	PCA	7E-02	6E+00	1E-01	1E+00	2E-01	2E+00	4E-01	7E+00	2E-06	6E-04	6E-06	2E-04	9E-07	3E-05	9E-06	6E-04	<0.1
HLP	HLP	1E-02	1E+00	2E-02	2E-01	2E-01	1E+00	2E-01	2E+00	3E-07	1E-04	3E-07	9E-06	3E-06	1E-04	4E-06	1E-04	<0.1
LA	PCA	1E-04	1E-03	5E-02	5E-01	2E-01	2E+00	2E-01	2E+00	4E-09	1E-07	3E-06	8E-05	9E-07	3E-05	4E-06	9E-05	<0.1
LCPD	PCA	7E-03	6E-01	--	--	2E-01	2E+00	2E-01	2E+00	1E-08	4E-06	--	--	9E-07	3E-05	1E-06	3E-05	<0.1
PDC	PCA	1E-03	1E-01	1E-02	1E-01	2E-01	2E+00	2E-01	2E+00	2E-09	6E-07	3E-07	1E-05	9E-07	3E-05	1E-06	3E-05	<0.1
PDD	PCA	4E-02	3E+00	8E-02	7E-01	2E-01	2E+00	3E-01	4E+00	6E-07	2E-04	4E-06	1E-04	9E-07	3E-05	5E-06	2E-04	<0.1
PDE	PCA	4E-02	4E+00	--	--	2E-01	2E+00	2E-01	4E+00	5E-07	1E-04	--	--	9E-07	3E-05	1E-06	2E-04	<0.1
RGT	RGWRD	1E-04	1E-02	1E-02	1E-01	2E-02	2E-01	3E-02	2E-01	1E-09	4E-07	5E-07	1E-05	6E-07	2E-05	1E-06	2E-05	<0.1
RPD	RGWRD	8E-02	7E+00	--	--	2E-02	2E-01	1E-01	7E+00	2E-06	6E-04	--	--	6E-07	2E-05	3E-06	6E-04	<0.1
RRB	RGWRD	1E-01	9E+00	--	--	2E-02	2E-01	1E-01	9E+00	3E-06	9E-04	--	--	6E-07	2E-05	4E-06	1E-03	<0.1
SC1	PCA	3E-02	2E+00	4E-02	4E-01	2E-01	2E+00	2E-01	3E+00	7E-07	2E-04	1E-06	3E-05	9E-07	3E-05	3E-06	2E-04	<0.1
SCHW	AH&P	2E-04	2E-02	7E-03	6E-02	4E-01	4E+00	4E-01	4E+00	1E-09	4E-07	1E-07	4E-06	1E-06	4E-05	1E-06	4E-05	<0.1
SGPD	AH&P	7E-03	6E-01	--	--	4E-01	4E+00	4E-01	4E+00	2E-08	5E-06	--	--	1E-06	4E-05	1E-06	4E-05	<0.1
SPL	PCA	4E-02	3E+00	1E-01	1E+00	2E-01	2E+00	3E-01	4E+00	8E-07	2E-04	6E-06	2E-04	9E-07	3E-05	8E-06	2E-04	<0.1
SWPD	AH&P	7E-03	6E-01	--	--	4E-01	4E+00	4E-01	4E+00	1E-08	4E-06	--	--	1E-06	4E-05	1E-06	4E-05	<0.1
--	LP	--	--	--	--	7E-01	7E+00	7E-01	7E+00	--	--	--	--	4E-06	1E-04	4E-06	1E-04	<0.1

Shaded cells indicate locations where noncancer risks exceed an HI of 1E+00 , a cancer risk of 1E-04, or a P10 value of 5%.

Total Risk = RME (exposure pathway with maximum risk) + (30/9)*CTE (all other exposure pathways)

Table 5-10

Total Risks to Hypothetical Future Residents from Ingestion of On-Site Groundwater and Soil

Panel A. Dissolved Metals

Exposure Units		Non Cancer HI						Cancer Risk						P10 (%) (lead)
Groundwater Well	Soil Exposure Unit	Groundwater		Soil		Total		Groundwater		Soil		Total		
		CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	
BED-8	AH&P	6E+00	1E+01	1E+01	3E+01	2E+01	5E+01	2E-05	2E-04	3E-05	3E-04	5E-05	3E-04	<0.1
CDM01b	PCA	6E+00	1E+01	4E+00	1E+01	1E+01	3E+01	2E-05	2E-04	2E-05	2E-04	5E-05	3E-04	<0.1
CDM02	PCA	3E+01	7E+01	4E+00	1E+01	4E+01	8E+01	2E-05	2E-04	2E-05	2E-04	5E-05	3E-04	<0.1
CDM03b	PCA	4E+02	7E+02	4E+00	1E+01	4E+02	8E+02	2E-03	1E-02	2E-05	2E-04	2E-03	1E-02	79
CDM04b	PCA	7E+00	2E+01	4E+00	1E+01	1E+01	3E+01	3E-04	2E-03	2E-05	2E-04	3E-04	2E-03	65
GE-MW-06	LP	2E+01	4E+01	2E+01	5E+01	4E+01	1E+02	1E-04	1E-03	1E-04	1E-03	2E-04	1E-03	65
GE-MW-07	PCA	1E+01	3E+01	4E+00	1E+01	2E+01	4E+01	3E-05	2E-04	2E-05	2E-04	5E-05	3E-04	<0.1
GE-MW-08	AH&P	1E+02	3E+02	1E+01	3E+01	1E+02	3E+02	5E-04	4E-03	3E-05	3E-04	6E-04	4E-03	100
GE-MW-15	PCA	5E+01	1E+02	4E+00	1E+01	6E+01	1E+02	2E-05	1E-04	2E-05	2E-04	4E-05	3E-04	1.29
GE-MW-16	PCA	5E+01	1E+02	4E+00	1E+01	6E+01	1E+02	8E-05	5E-04	2E-05	2E-04	1E-04	6E-04	<0.1
GE-MW-17	PCA	3E+01	7E+01	4E+00	1E+01	4E+01	8E+01	8E-06	6E-05	2E-05	2E-04	3E-05	2E-04	1.4
GW-10A	RGWRD	2E+00	3E+00	5E-01	1E+00	2E+00	5E+00	2E-05	2E-04	2E-05	1E-04	4E-05	2E-04	<0.1
GW-8	RGWRD	3E+01	6E+01	5E-01	1E+00	3E+01	6E+01	5E-05	4E-04	2E-05	1E-04	7E-05	4E-04	<0.1
GWCDM11	PCA	5E+00	1E+01	4E+00	1E+01	9E+00	2E+01	2E-05	2E-04	2E-05	2E-04	5E-05	3E-04	<0.1
GWCDM12	PCA	1E+01	3E+01	4E+00	1E+01	2E+01	4E+01	2E-05	2E-04	2E-05	2E-04	5E-05	3E-04	<0.1
--	HLP	--	--	4E+00	1E+01	4E+00	1E+01	--	--	7E-05	7E-04	7E-05	7E-04	0.50

Panel B. Total Metals

Exposure Units		Non Cancer HI						Cancer Risk						P10 (%) (lead)
Groundwater Well	Soil Exposure Unit	Groundwater		Soil		Total		Groundwater		Soil		Total		
		CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	
BED-8	AH&P	6E+00	1E+01	1E+01	3E+01	2E+01	4E+01	2E-05	2E-04	3E-05	3E-04	5E-05	3E-04	<0.1
CDM01b	PCA	8E+00	2E+01	4E+00	1E+01	1E+01	3E+01	4E-05	3E-04	2E-05	2E-04	6E-05	4E-04	<0.1
CDM02	PCA	3E+01	6E+01	4E+00	1E+01	3E+01	7E+01	3E-05	2E-04	2E-05	2E-04	5E-05	3E-04	<0.1
CDM03b	PCA	4E+02	8E+02	4E+00	1E+01	4E+02	8E+02	3E-03	2E-02	2E-05	2E-04	3E-03	2E-02	89
CDM04b	PCA	3E+01	7E+01	4E+00	1E+01	4E+01	8E+01	1E-03	9E-03	2E-05	2E-04	1E-03	9E-03	100
GE-MW-06	LP	2E+01	4E+01	2E+01	5E+01	4E+01	9E+01	2E-04	1E-03	1E-04	1E-03	3E-04	1E-03	71
GE-MW-07	PCA	1E+01	3E+01	4E+00	1E+01	2E+01	4E+01	3E-05	2E-04	2E-05	2E-04	5E-05	3E-04	<0.1
GE-MW-08	AH&P	1E+02	3E+02	1E+01	3E+01	2E+02	3E+02	6E-04	4E-03	3E-05	3E-04	6E-04	4E-03	100
GE-MW-15	PCA	4E+01	8E+01	4E+00	1E+01	4E+01	9E+01	--	--	2E-05	2E-04	2E-05	2E-04	1
GE-MW-16	PCA	6E+01	1E+02	4E+00	1E+01	6E+01	1E+02	1E-04	8E-04	2E-05	2E-04	1E-04	8E-04	1
GE-MW-17	PCA	3E+01	7E+01	4E+00	1E+01	4E+01	8E+01	8E-06	6E-05	2E-05	2E-04	3E-05	2E-04	2
GW-10A	RGWRD	2E+00	4E+00	5E-01	1E+00	2E+00	5E+00	3E-05	2E-04	2E-05	1E-04	5E-05	3E-04	10
GW-8	RGWRD	3E+01	6E+01	5E-01	1E+00	3E+01	7E+01	1E-04	8E-04	2E-05	1E-04	1E-04	9E-04	<0.1
GWCDM11	PCA	1E+01	3E+01	4E+00	1E+01	2E+01	4E+01	5E-05	4E-04	2E-05	2E-04	7E-05	4E-04	<0.1
GWCDM12	PCA	1E+01	3E+01	4E+00	1E+01	2E+01	4E+01	5E-05	3E-04	2E-05	2E-04	7E-05	4E-04	<0.1
--	HLP	--	--	4E+00	1E+01	4E+00	1E+01	--	--	7E-05	7E-04	7E-05	7E-04	0.50

Shaded cells indicate locations where noncancer risks exceed an HI of 1E+00 or a cancer risk of 1E-04.

Total Risk = RME (exposure pathway with maximum risk) + (30/9)*CTE (all other exposure pathways)

Table 5-11

Total Risks to Hypothetical Future Commercial Workers from Ingestion of On-Site Groundwater and Surface Soil

Panel A. Dissolved Metals

Exposure Units		Non Cancer HI						Cancer Risk						$P10_{fetus}$ (%) (lead)
Groundwater Well	Soil Exposure Unit	Groundwater		Soil		Total		Groundwater		Soil		Total		
		CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	
BED-8	AH&P	2E+00	4E+00	2E+00	4E+00	4E+00	1E+01	5E-06	4E-05	3E-06	3E-05	7E-06	5E-05	< 0.1
CDM01b	PCA	2E+00	4E+00	7E-01	1E+00	3E+00	6E+00	5E-06	4E-05	2E-06	2E-05	7E-06	5E-05	< 0.1
CDM02	PCA	1E+01	2E+01	7E-01	1E+00	1E+01	2E+01	5E-06	4E-05	2E-06	2E-05	7E-06	5E-05	< 0.1
CDM03b	PCA	1E+02	2E+02	7E-01	1E+00	1E+02	2E+02	3E-04	3E-03	2E-06	2E-05	3E-04	3E-03	3
CDM04b	PCA	3E+00	4E+00	7E-01	1E+00	3E+00	7E+00	5E-05	4E-04	2E-06	2E-05	5E-05	4E-04	1.4
GE-MW-06	LP	7E+00	1E+01	3E+00	6E+00	1E+01	2E+01	3E-05	2E-04	9E-06	1E-04	4E-05	3E-04	0.5
GE-MW-07	PCA	5E+00	8E+00	7E-01	1E+00	5E+00	1E+01	6E-06	5E-05	2E-06	2E-05	8E-06	5E-05	< 0.1
GE-MW-08	AH&P	5E+01	8E+01	2E+00	4E+00	5E+01	8E+01	1E-04	9E-04	3E-06	3E-05	1E-04	9E-04	77
GE-MW-15	PCA	2E+01	3E+01	7E-01	1E+00	2E+01	3E+01	4E-06	3E-05	2E-06	2E-05	6E-06	4E-05	< 0.1
GE-MW-16	PCA	2E+01	3E+01	7E-01	1E+00	2E+01	3E+01	2E-05	1E-04	2E-06	2E-05	2E-05	1E-04	< 0.1
GE-MW-17	PCA	1E+01	2E+01	7E-01	1E+00	1E+01	2E+01	2E-06	1E-05	2E-06	2E-05	4E-06	3E-05	< 0.1
GW-10A	RGWRD	6E-01	1E+00	8E-02	2E-01	7E-01	1E+00	4E-06	4E-05	1E-06	2E-05	6E-06	4E-05	< 0.1
GW-8	RGWRD	1E+01	2E+01	8E-02	2E-01	1E+01	2E+01	1E-05	8E-05	1E-06	2E-05	1E-05	9E-05	< 0.1
GWCDM11	PCA	2E+00	3E+00	7E-01	1E+00	3E+00	5E+00	5E-06	4E-05	2E-06	2E-05	7E-06	5E-05	< 0.1
GWCDM12	PCA	5E+00	9E+00	7E-01	1E+00	6E+00	1E+01	5E-06	4E-05	2E-06	2E-05	7E-06	5E-05	< 0.1
--	HLP	--	--	6E-01	1E+00	6E-01	1E+00	--	--	7E-06	8E-05	7E-06	8E-05	< 0.1

Panel B. Total Metals

Exposure Units		Non Cancer HI						Cancer Risk						$P10_{fetus}$ (%) (lead)
Groundwater Well	Soil Exposure Unit	Groundwater		Soil		Total		Groundwater		Soil		Total		
		CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	
BED-8	AH&P	2E+00	4E+00	2E+00	4E+00	4E+00	9E+00	5E-06	4E-05	3E-06	3E-05	7E-06	5E-05	< 0.1
CDM01b	PCA	3E+00	5E+00	7E-01	1E+00	4E+00	7E+00	8E-06	7E-05	2E-06	2E-05	1E-05	8E-05	< 0.1
CDM02	PCA	1E+01	2E+01	7E-01	1E+00	1E+01	2E+01	6E-06	5E-05	2E-06	2E-05	8E-06	6E-05	< 0.1
CDM03b	PCA	1E+02	2E+02	7E-01	1E+00	1E+02	2E+02	5E-04	4E-03	2E-06	2E-05	5E-04	4E-03	6
CDM04b	PCA	1E+01	2E+01	7E-01	1E+00	1E+01	2E+01	3E-04	2E-03	2E-06	2E-05	3E-04	2E-03	86
GE-MW-06	LP	7E+00	1E+01	3E+00	6E+00	1E+01	2E+01	3E-05	3E-04	9E-06	1E-04	4E-05	3E-04	0.8
GE-MW-07	PCA	5E+00	8E+00	7E-01	1E+00	6E+00	1E+01	5E-06	4E-05	2E-06	2E-05	7E-06	5E-05	< 0.1
GE-MW-08	AH&P	5E+01	8E+01	2E+00	4E+00	5E+01	9E+01	1E-04	9E-04	3E-06	3E-05	1E-04	1E-03	81
GE-MW-15	PCA	1E+01	2E+01	7E-01	1E+00	1E+01	3E+01	--	--	2E-06	2E-05	2E-06	2E-05	< 0.1
GE-MW-16	PCA	2E+01	3E+01	7E-01	1E+00	2E+01	4E+01	2E-05	2E-04	2E-06	2E-05	2E-05	2E-04	< 0.1
GE-MW-17	PCA	1E+01	2E+01	7E-01	1E+00	1E+01	2E+01	2E-06	1E-05	2E-06	2E-05	4E-06	3E-05	< 0.1
GW-10A	RGWRD	7E-01	1E+00	8E-02	2E-01	8E-01	1E+00	6E-06	5E-05	1E-06	2E-05	8E-06	6E-05	< 0.1
GW-8	RGWRD	1E+01	2E+01	8E-02	2E-01	1E+01	2E+01	2E-05	2E-04	1E-06	2E-05	3E-05	2E-04	< 0.1
GWCDM11	PCA	5E+00	7E+00	7E-01	1E+00	5E+00	1E+01	1E-05	8E-05	2E-06	2E-05	1E-05	9E-05	< 0.1
GWCDM12	PCA	5E+00	8E+00	7E-01	1E+00	5E+00	1E+01	1E-05	8E-05	2E-06	2E-05	1E-05	9E-05	< 0.1
--	HLP	--	--	6E-01	1E+00	6E-01	1E+00	--	--	7E-06	8E-05	7E-06	8E-05	< 0.1

Shaded cells indicate locations where noncancer risks exceed an HI of 1E+00 or a cancer risk of 1E-04 or a P10 value of 5%.

Total Risk = RME (exposure pathway with maximum risk) + (30/9)*CTE (all other exposure pathways)

Table 5-12

Total Risks to Children from Surface Water and Sediment in Off-Site Drainages

Exposure Unit	Non Cancer HI						Cancer Risk						P10 (%) (lead)
	Surface Water		Sediment		Total		Surface Water		Sediment		Total		
	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	
BBC0	7E-04	2E-02	6E-02	2E-01	6E-02	2E-01	2E-09	2E-07	4E-07	5E-06	4E-07	5E-06	< 0.1
BBC1	7E-04	3E-02	6E-02	3E-01	7E-02	3E-01	1E-09	1E-07	5E-07	6E-06	5E-07	6E-06	< 0.1
BBC2	7E-04	2E-02	5E-02	2E-01	5E-02	2E-01	2E-09	2E-07	3E-07	4E-06	3E-07	4E-06	< 0.1
BBC3	9E-04	3E-02	1E-01	4E-01	1E-01	4E-01	1E-09	1E-07	7E-07	9E-06	7E-07	9E-06	< 0.1
BBC4	6E-04	2E-02	1E-01	6E-01	1E-01	6E-01	9E-10	1E-07	1E-06	2E-05	1E-06	2E-05	< 0.1
BHG	7E-04	3E-02	2E-02	7E-02	2E-02	7E-02	2E-09	3E-07	6E-08	7E-07	6E-08	7E-07	< 0.1
BKD1	4E-04	1E-02	3E-02	1E-01	3E-02	1E-01	1E-09	1E-07	3E-07	3E-06	3E-07	3E-06	< 0.1
BMG	4E-04	1E-02	4E-02	1E-01	4E-02	2E-01	7E-10	8E-08	5E-08	6E-07	5E-08	6E-07	< 0.1
CC	8E-04	3E-02	2E-02	1E-01	3E-02	1E-01	3E-09	3E-07	8E-08	1E-06	9E-08	1E-06	< 0.1
HG	9E-03	3E-01	1E-01	4E-01	1E-01	5E-01	2E-08	2E-06	7E-07	9E-06	8E-07	9E-06	< 0.1
OFA	2E-03	5E-02	2E-01	7E-01	2E-01	7E-01	2E-09	2E-07	8E-07	9E-06	8E-07	9E-06	< 0.1
RG	2E-02	8E-01	7E-02	3E-01	9E-02	1E+00	2E-09	2E-07	5E-07	7E-06	5E-07	7E-06	< 0.1
SC2	1E-03	4E-02	9E-02	3E-01	9E-02	3E-01	7E-10	8E-08	5E-07	6E-06	5E-07	6E-06	< 0.1
SC3	8E-04	3E-02	7E-02	3E-01	7E-02	3E-01	9E-10	9E-08	5E-07	6E-06	5E-07	6E-06	< 0.1
SC4	7E-04	3E-02	1E-01	4E-01	1E-01	4E-01	9E-10	1E-07	6E-07	8E-06	6E-07	8E-06	< 0.1
TG	6E-04	2E-02	2E-02	7E-02	2E-02	8E-02	1E-09	1E-07	2E-08	3E-07	2E-08	3E-07	< 0.1

Shaded cells indicate locations where noncancer risks exceed an HI of 1E+00 , a cancer risk of 1E-04, or a P10 value of 5%.

Total Risk = RME (exposure pathway with maximum risk) + (30/9)*CTE (all other exposure pathways)

Table 5-13

Total Risks to Recreational Fisherman from Surface Water, Sediment, and Fish in Off-Site Drainages

Exposure Unit	Non Cancer HI								Cancer Risk								$P10_{fetus}$ (%) (lead)
	Surface Water		Sediment		Fish		Total		Surface Water		Sediment		Fish		Total		
	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	
BBC0	1E-05	1E-03	6E-04	6E-03	3E-03	5E-02	4E-03	6E-02	1E-10	4E-08	1E-08	5E-07	7E-08	4E-06	8E-08	4E-06	< 0.1
BBC1	2E-05	1E-03	7E-04	7E-03	5E-03	8E-02	6E-03	8E-02	7E-11	2E-08	2E-08	6E-07	1E-07	5E-06	1E-07	5E-06	< 0.1
BBC2	1E-05	1E-03	6E-04	6E-03	4E-03	7E-02	5E-03	7E-02	1E-10	4E-08	1E-08	4E-07	8E-08	5E-06	9E-08	5E-06	< 0.1
BBC3	2E-05	2E-03	1E-03	1E-02	6E-03	9E-02	7E-03	1E-01	1E-10	3E-08	3E-08	1E-06	9E-08	5E-06	1E-07	5E-06	< 0.1
BBC4	1E-05	1E-03	1E-03	2E-02	8E-03	1E-01	1E-02	1E-01	7E-11	2E-08	5E-08	2E-06	9E-08	5E-06	1E-07	5E-06	< 0.1
BHG	1E-05	1E-03	2E-04	2E-03	--	--	2E-04	2E-03	2E-10	6E-08	2E-09	8E-08	--	--	2E-09	8E-08	< 0.1
BKD1	9E-06	8E-04	3E-04	3E-03	--	--	3E-04	3E-03	9E-11	3E-08	9E-09	3E-07	--	--	9E-09	3E-07	< 0.1
BMG	8E-06	8E-04	4E-04	4E-03	2E-03	3E-02	2E-03	3E-02	5E-11	2E-08	2E-09	7E-08	4E-08	2E-06	4E-08	2E-06	< 0.1
CC	2E-05	2E-03	3E-04	3E-03	--	--	3E-04	3E-03	2E-10	7E-08	3E-09	1E-07	--	--	3E-09	1E-07	< 0.1
HG	2E-04	2E-02	1E-03	1E-02	--	--	1E-03	2E-02	2E-09	5E-07	3E-08	9E-07	--	--	3E-08	9E-07	< 0.1
OFA	3E-05	3E-03	2E-03	2E-02	--	--	2E-03	2E-02	2E-10	5E-08	3E-08	1E-06	--	--	3E-08	1E-06	< 0.1
RG	5E-04	4E-02	7E-04	7E-03	--	--	1E-03	5E-02	1E-10	5E-08	2E-08	7E-07	--	--	2E-08	7E-07	< 0.1
SC2	2E-05	2E-03	9E-04	9E-03	4E-03	6E-02	4E-03	6E-02	5E-11	2E-08	2E-08	6E-07	9E-08	5E-06	1E-07	5E-06	< 0.1
SC3	2E-05	2E-03	8E-04	8E-03	--	--	8E-04	8E-03	6E-11	2E-08	2E-08	6E-07	--	--	2E-08	6E-07	< 0.1
SC4	1E-05	1E-03	1E-03	1E-02	4E-03	7E-02	5E-03	7E-02	7E-11	2E-08	2E-08	8E-07	9E-08	5E-06	1E-07	5E-06	< 0.1
TG	1E-05	1E-03	2E-04	2E-03	--	--	2E-04	2E-03	7E-11	2E-08	8E-10	3E-08	--	--	9E-10	3E-08	< 0.1

Shaded cells indicate locations where noncancer risks exceed an HI of 1E+00 , a cancer risk of 1E-04, or a P10 value > 5%.

Total Risk = RME (exposure pathway with maximum risk) + (30/9)*CTE (exposure pathway)

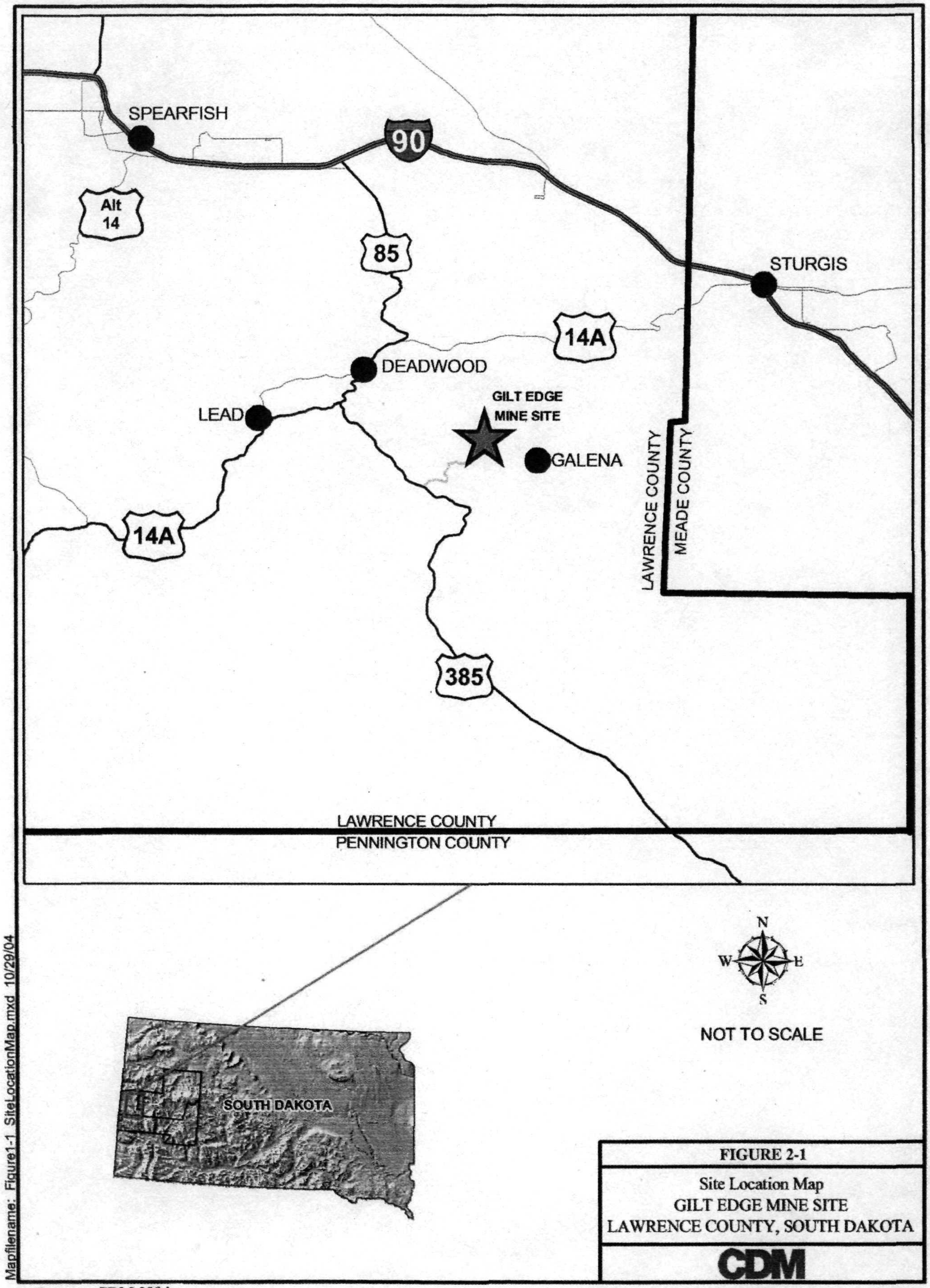
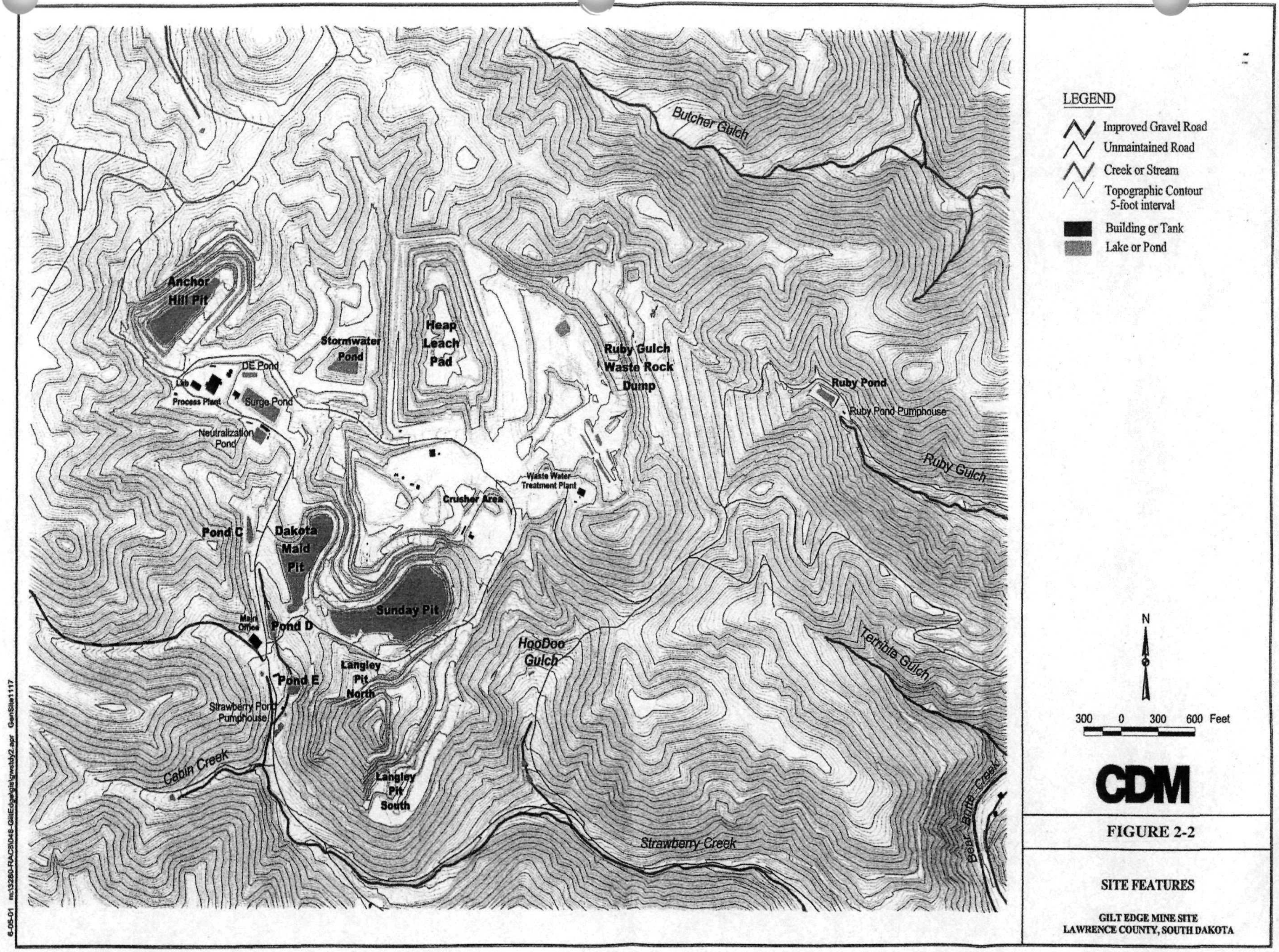


FIGURE 2-1

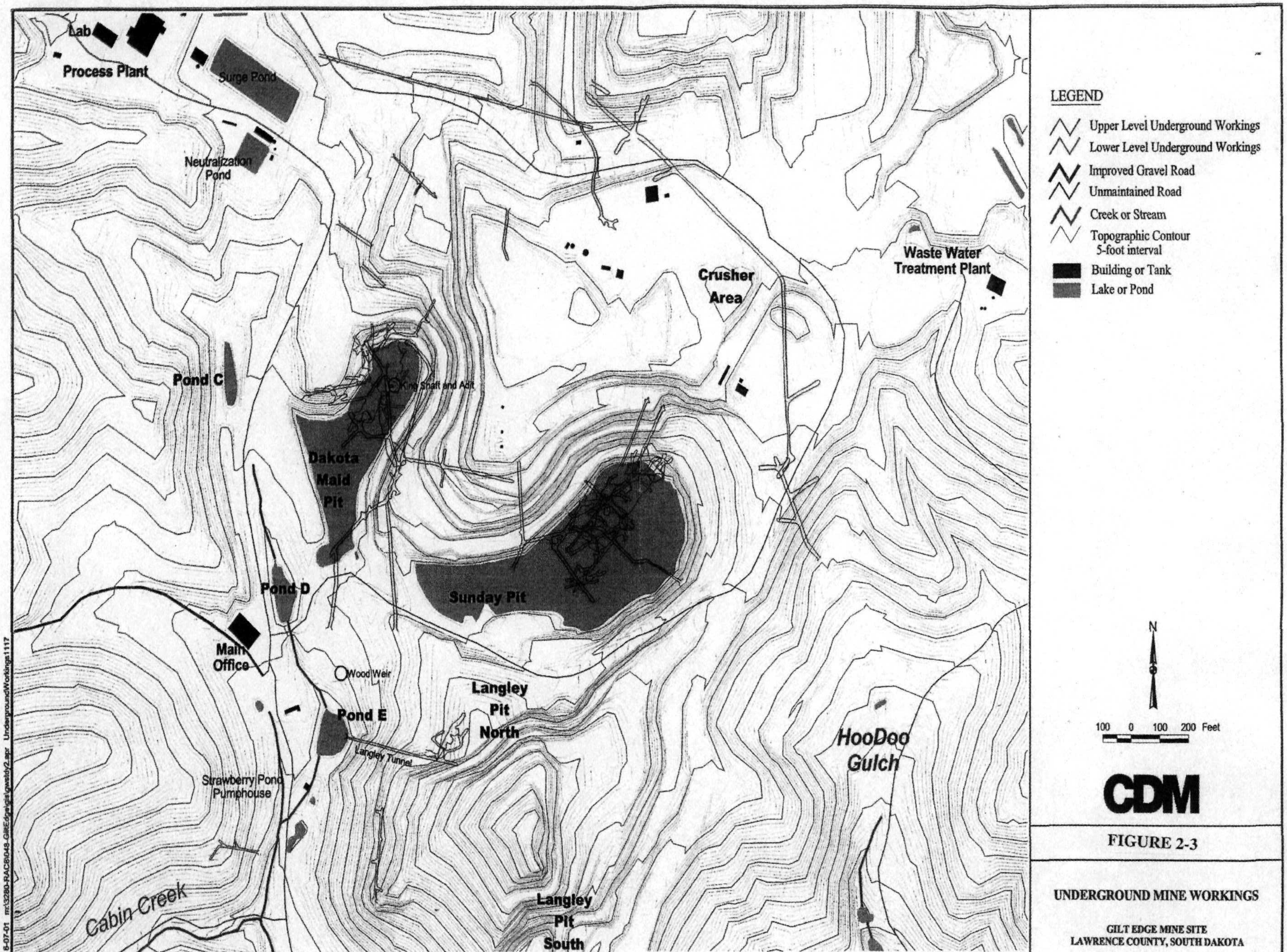
Site Location Map
GILT EDGE MINE SITE
LAWRENCE COUNTY, SOUTH DAKOTA

CDM

Source: CDM 2004a



Source: CDM 2003a



Source: CDM 2003a

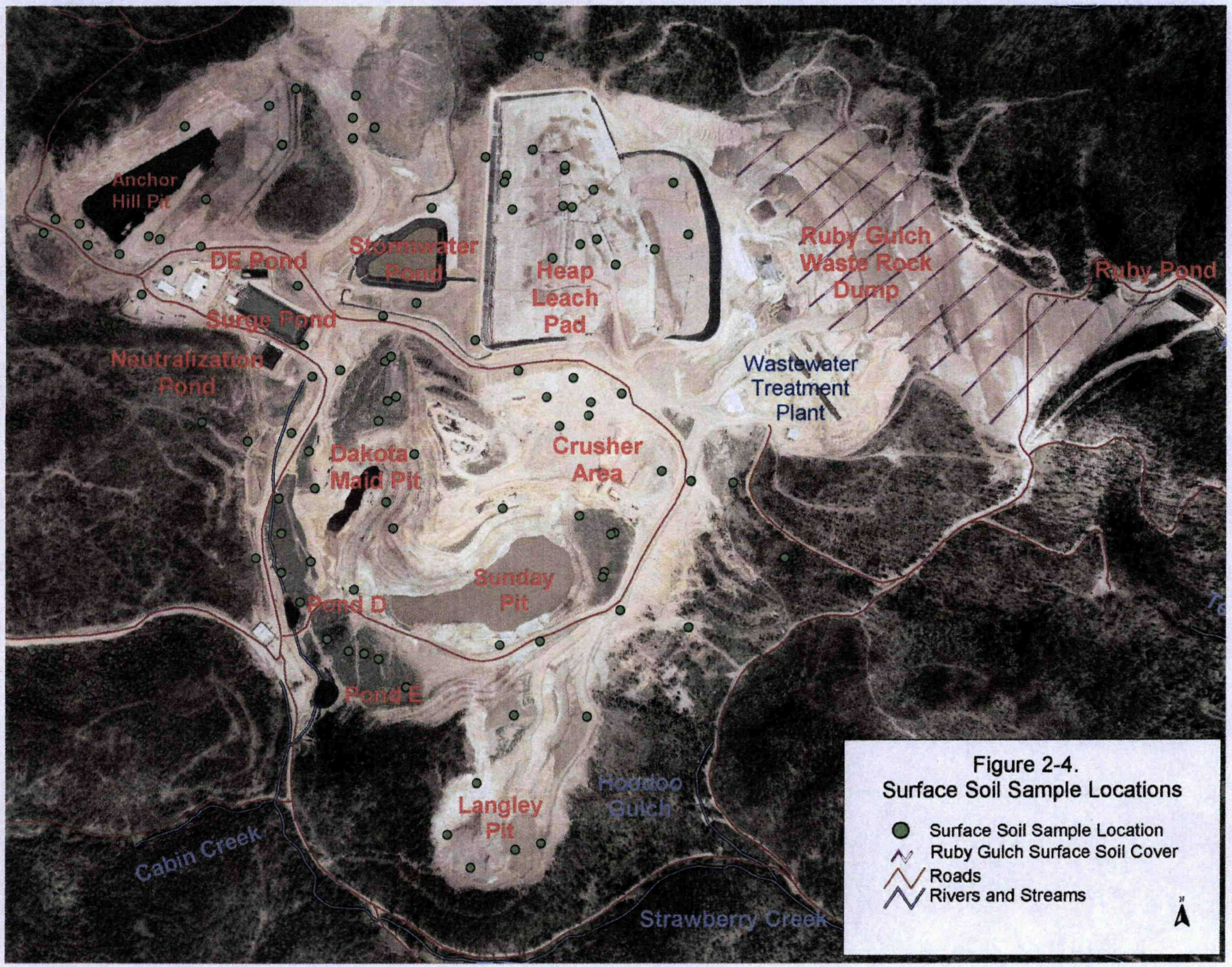


Figure 2-4.
Surface Soil Sample Locations

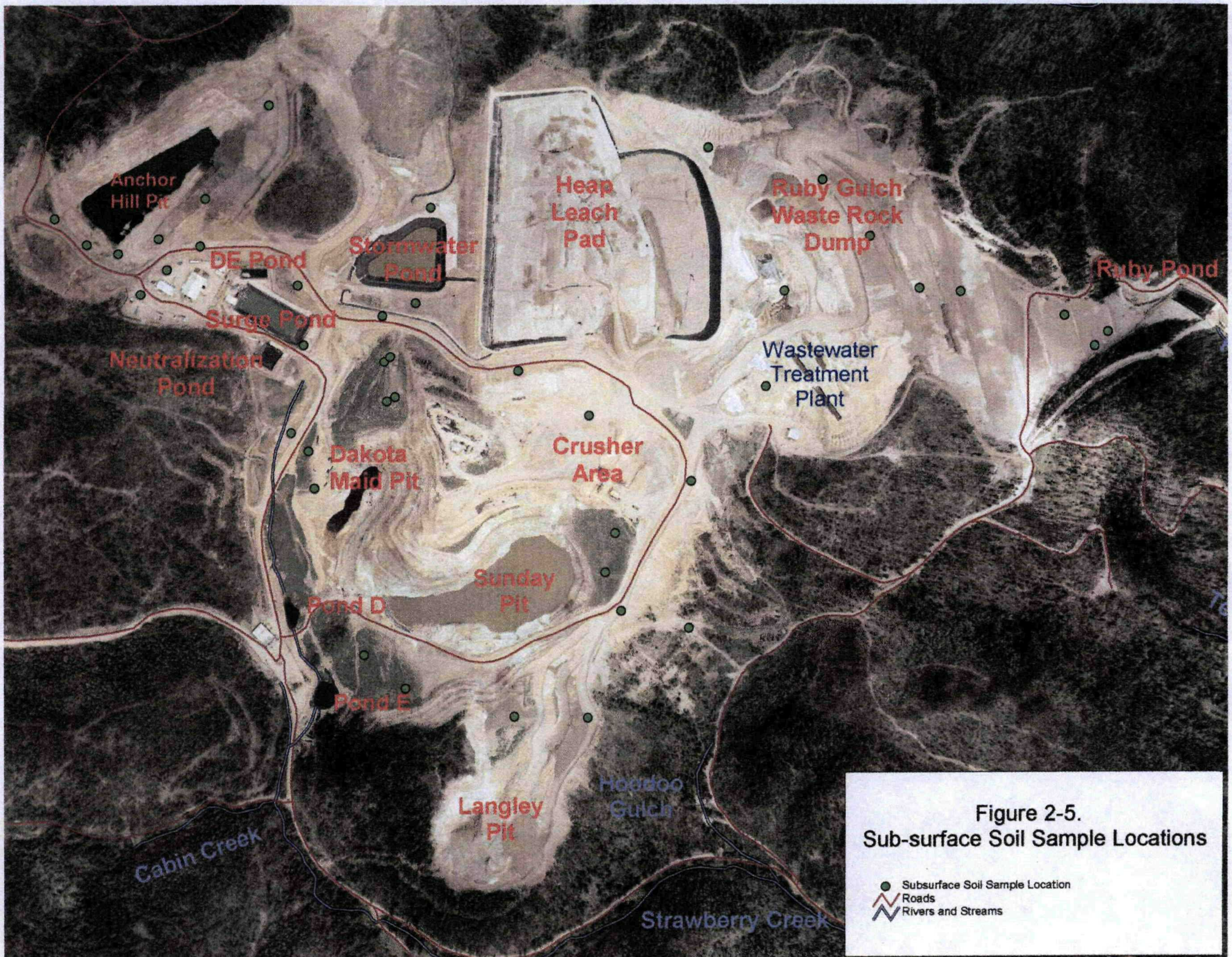


Figure 2-5.
Sub-surface Soil Sample Locations

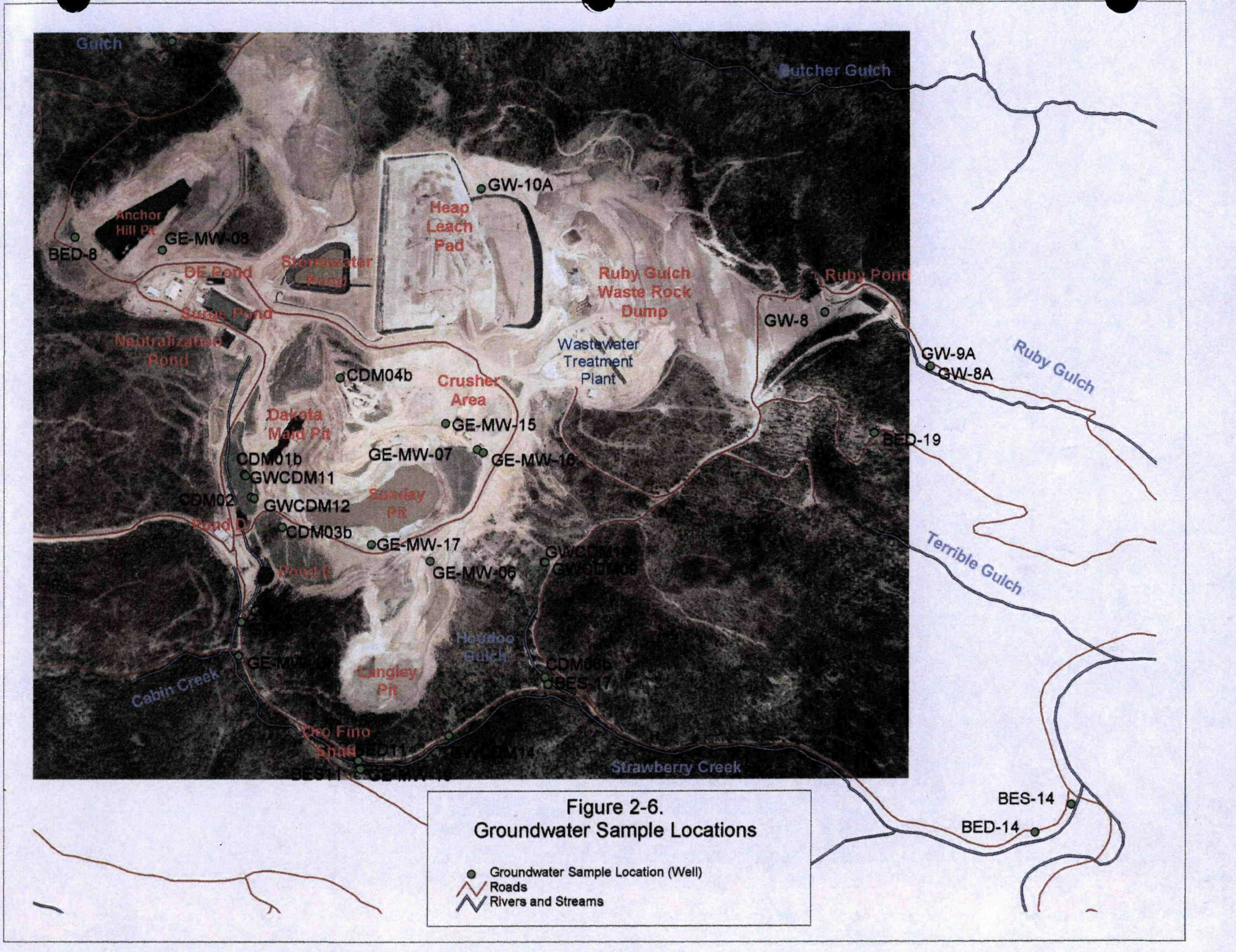


Figure 2-6.
Groundwater Sample Locations

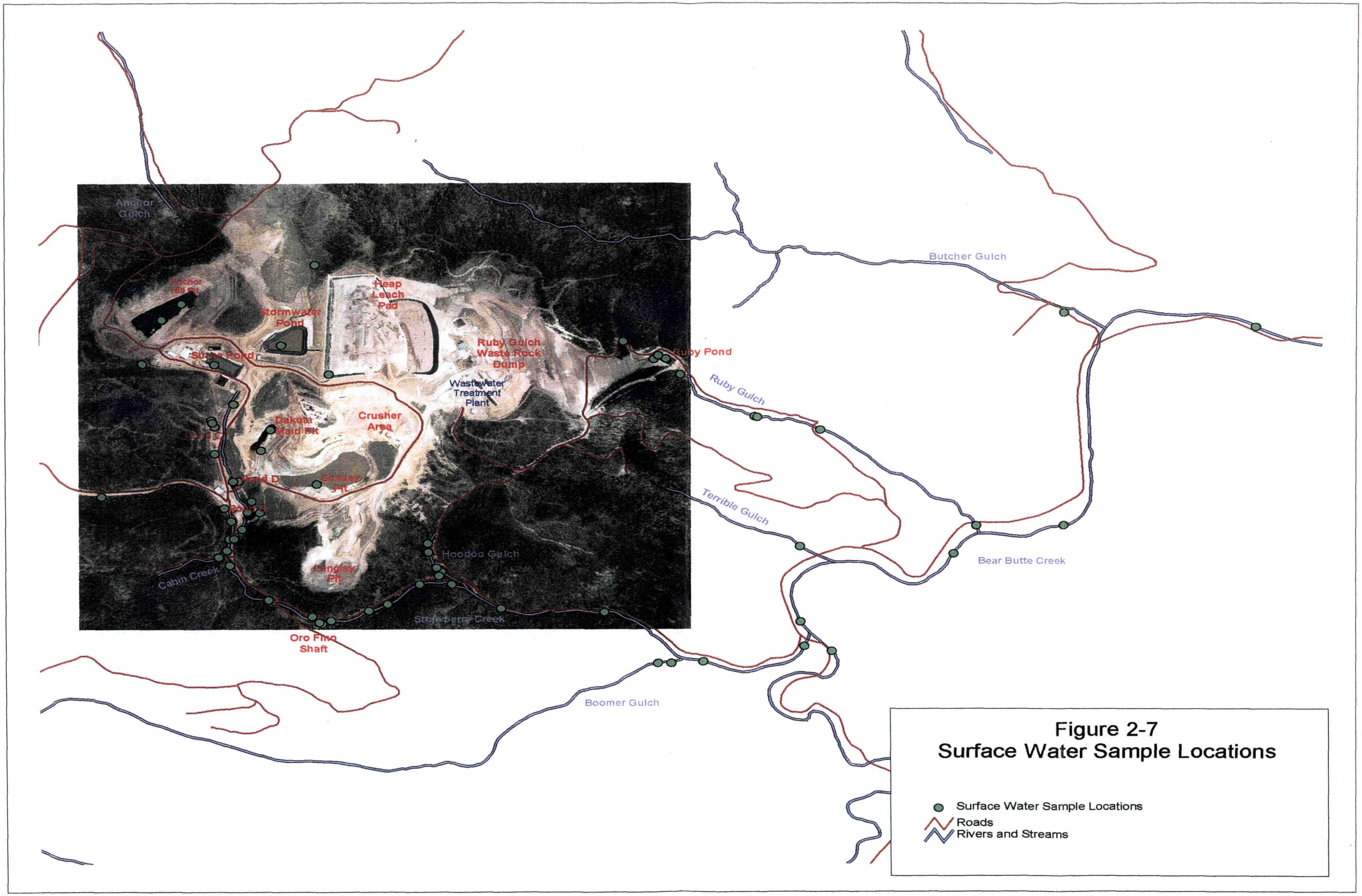


Figure 2-7
Surface Water Sample Locations

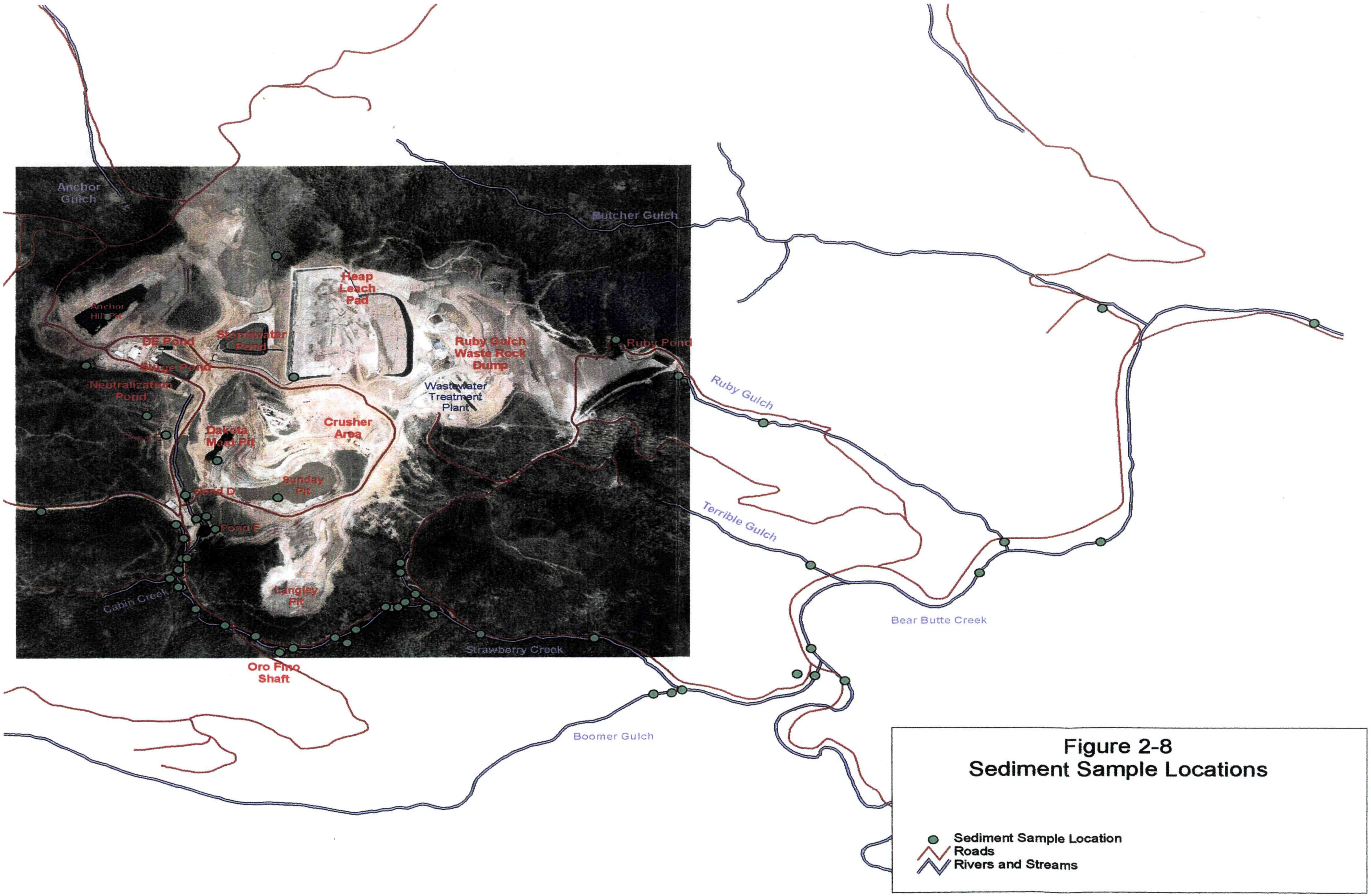


Figure 2-8
Sediment Sample Locations

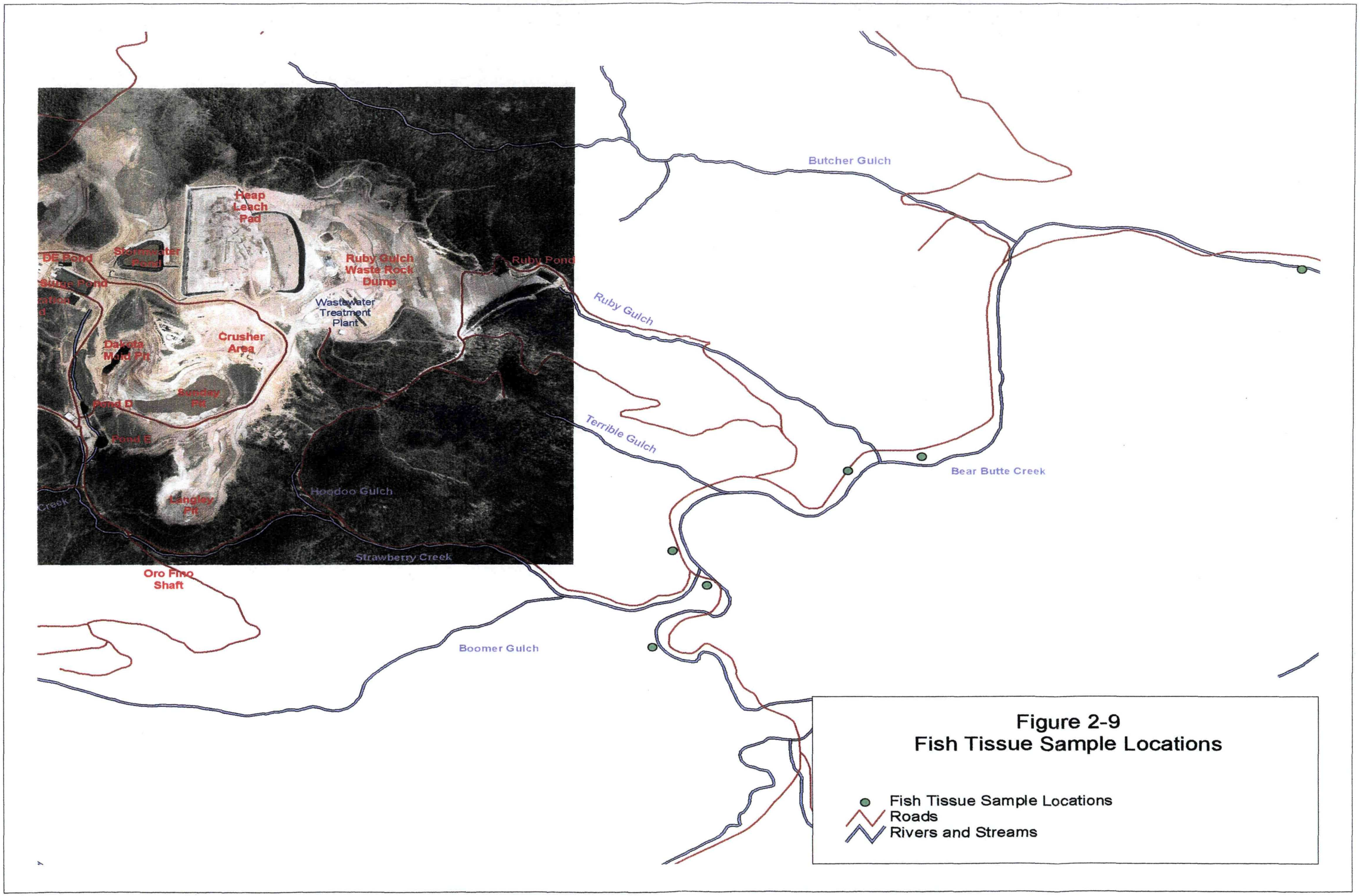


Figure 2-9
Fish Tissue Sample Locations

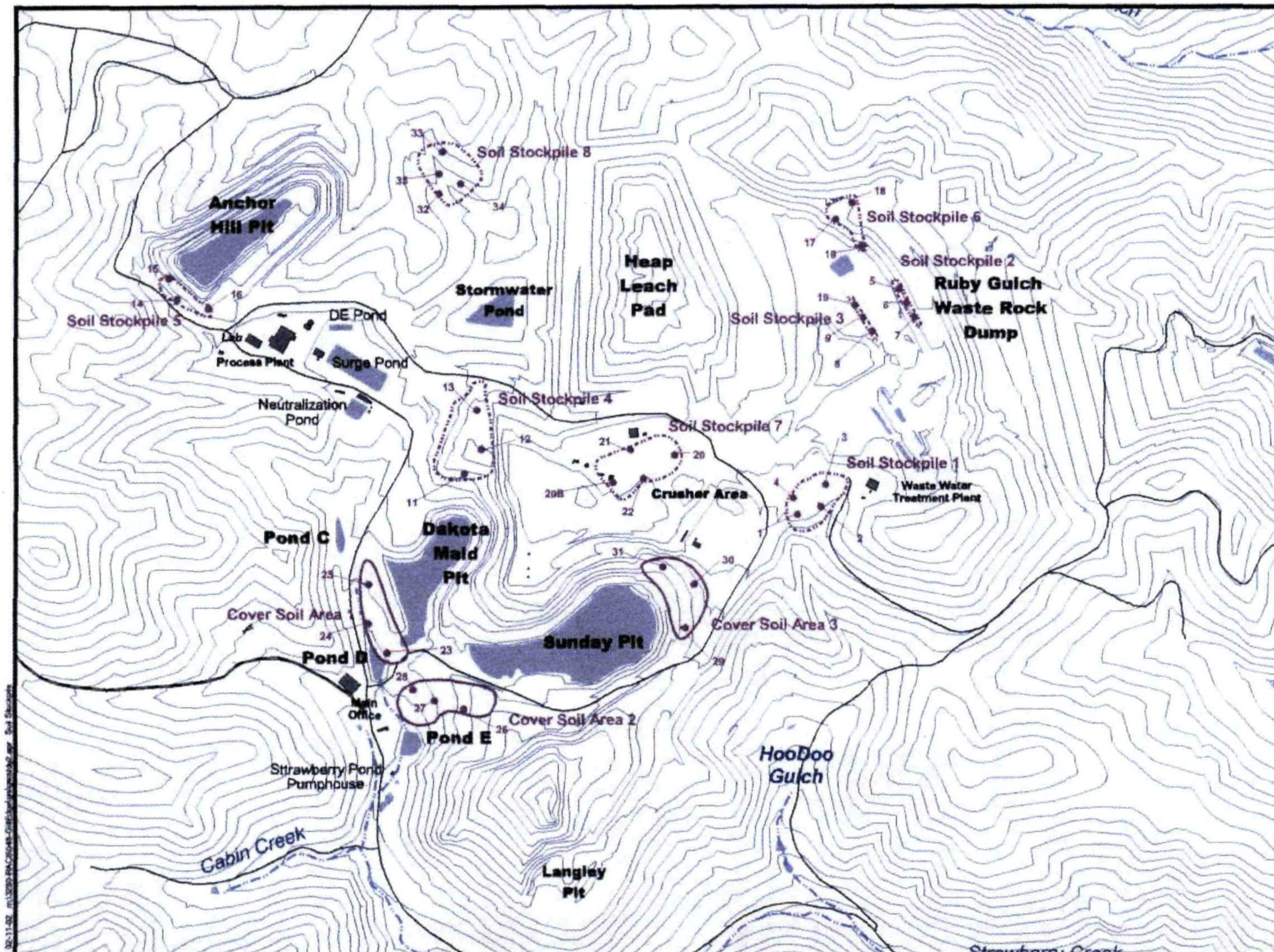


FIGURE 2-10

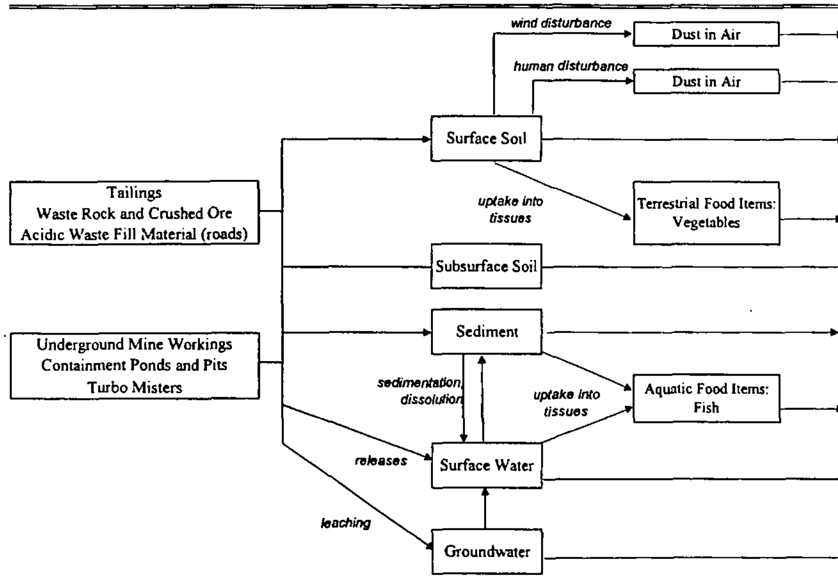
SOIL AND VEGETATION SAMPLE LOCATION MAP

GILT EDGE MINE SITE
LAWRENCE COUNTY, SOUTH DAKOTA

CDM

Source: CDM 2003b

Figure 3-1. Site Conceptual Model for Human Exposure



Potentially Impacted Media	Exposure Route	Exposed Population: On-Site (Mine Facility): Recreational Visitors: ATV Rider	Recreational Visitors: Hiker	Construction Worker[a]	Commerical Workers[a]	Residents[a]	Off-Site (Riparian Areas): Recreational Fisherman (Adult)	Residential Child (7-12 years)	Resident
Dust in Air (wind disturbance)	Inhalation	X	X	X	X	X			
Dust in Air (human disturbance)	Inhalation	●		●					
Surface Soil	Ingestion	●	●	●	●	●			
Surface Soil	Dermal	X	X	X	X	X			
Terrestrial Food Items: Vegetables	Ingestion					X			
Subsurface Soil	Ingestion			●					
Subsurface Soil	Dermal			X					
Sediment	Ingestion		●				●	●	
Sediment	Dermal		X				X	X	
Aquatic Food Items: Fish	Ingestion						●		
Surface Water	Ingestion		●				●	●	
Surface Water	Dermal		X				X	X	
Groundwater	Ingestion				●	●			●

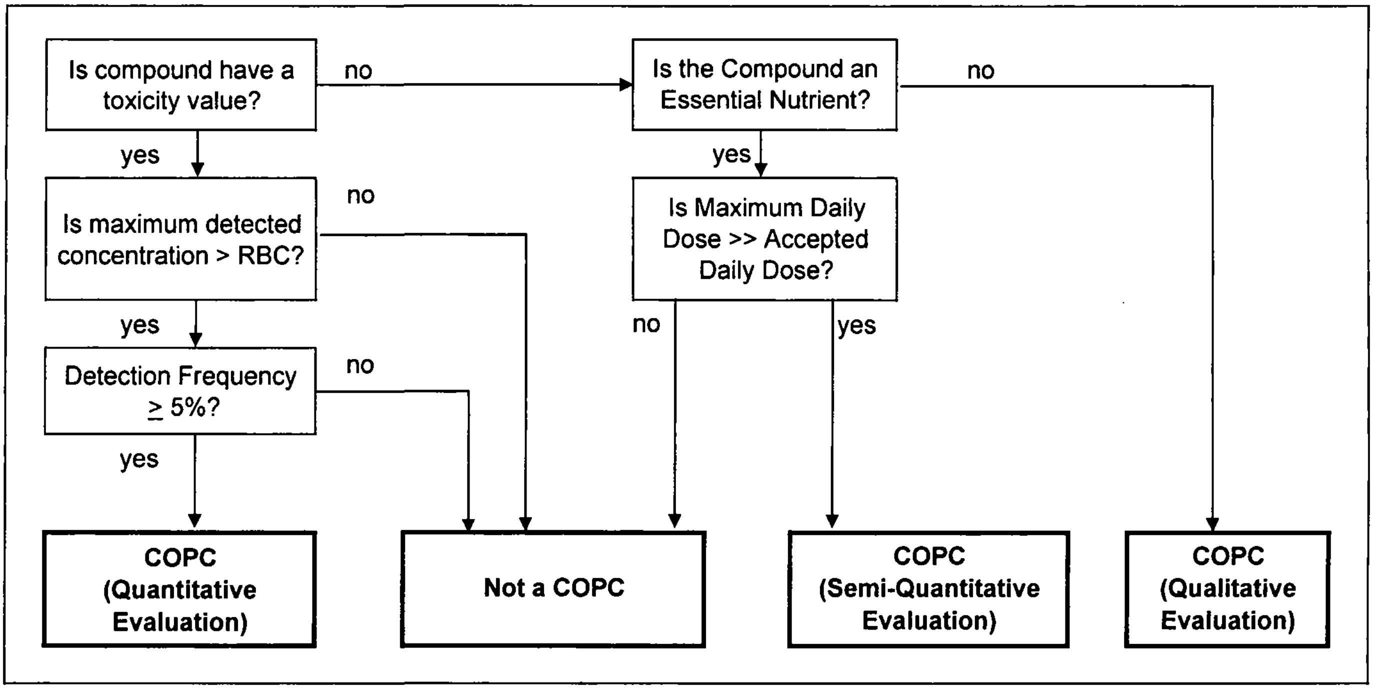
LEGEND

●	Pathway is complete and might be significant; sufficient data are available for quantitative evaluation
X	Pathway is or may be complete, however, risk is low or data are lacking. Qualitative evaluation only.
	Pathway is not complete; no evaluation required

Notes:

[a] Currently, this exposure pathway is incomplete; however, future hypothetical exposures will be evaluated.

Figure 3-2 COPC Selection Procedure



Notes:
RBC = Risk-based concentration (non-cancer Hazard Quotient (HQ) = 0.1, Cancer risk = 1E-06)
COPC = chemical of potential concern
DL = Detection Limit

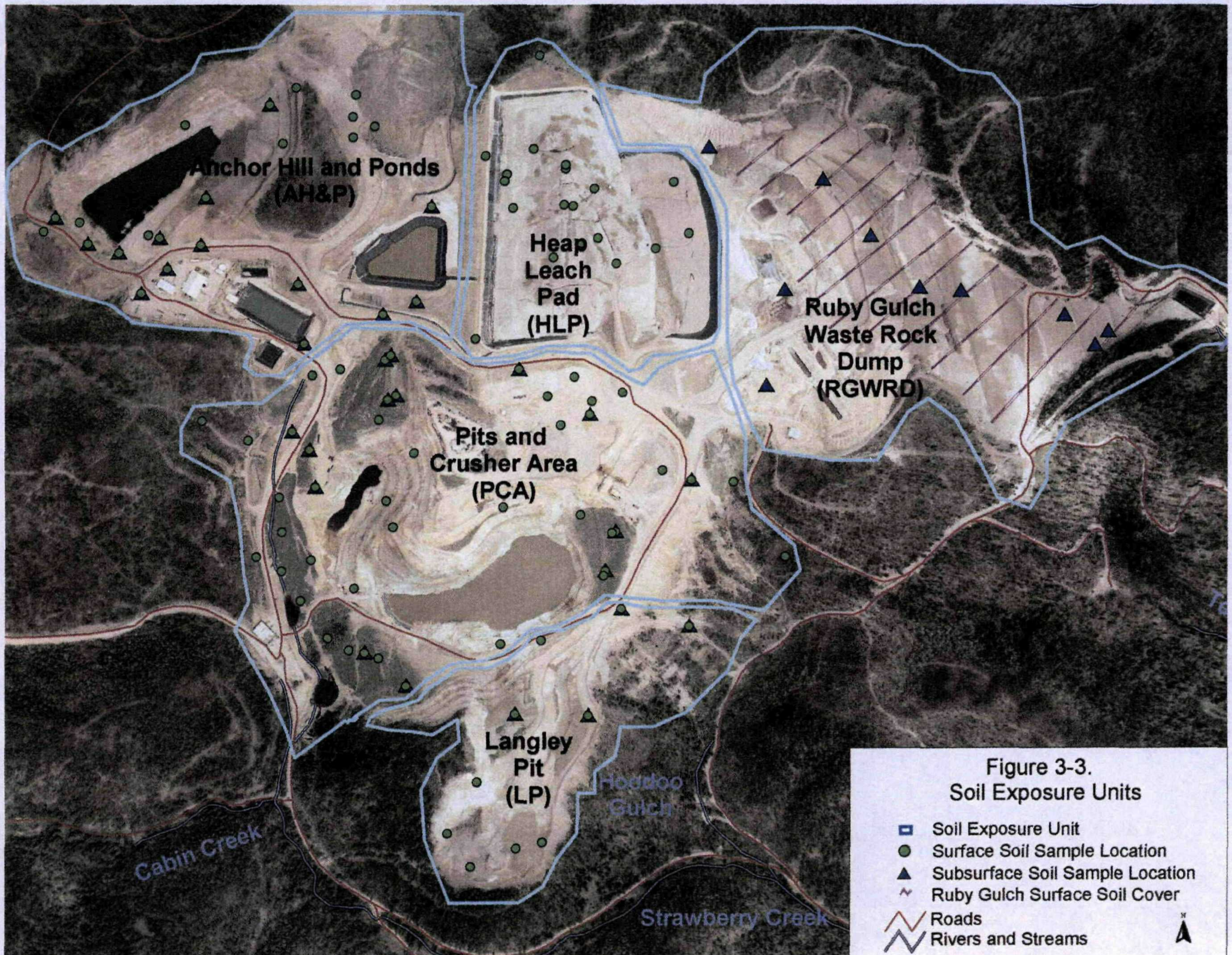


Figure 3-3.
Soil Exposure Units

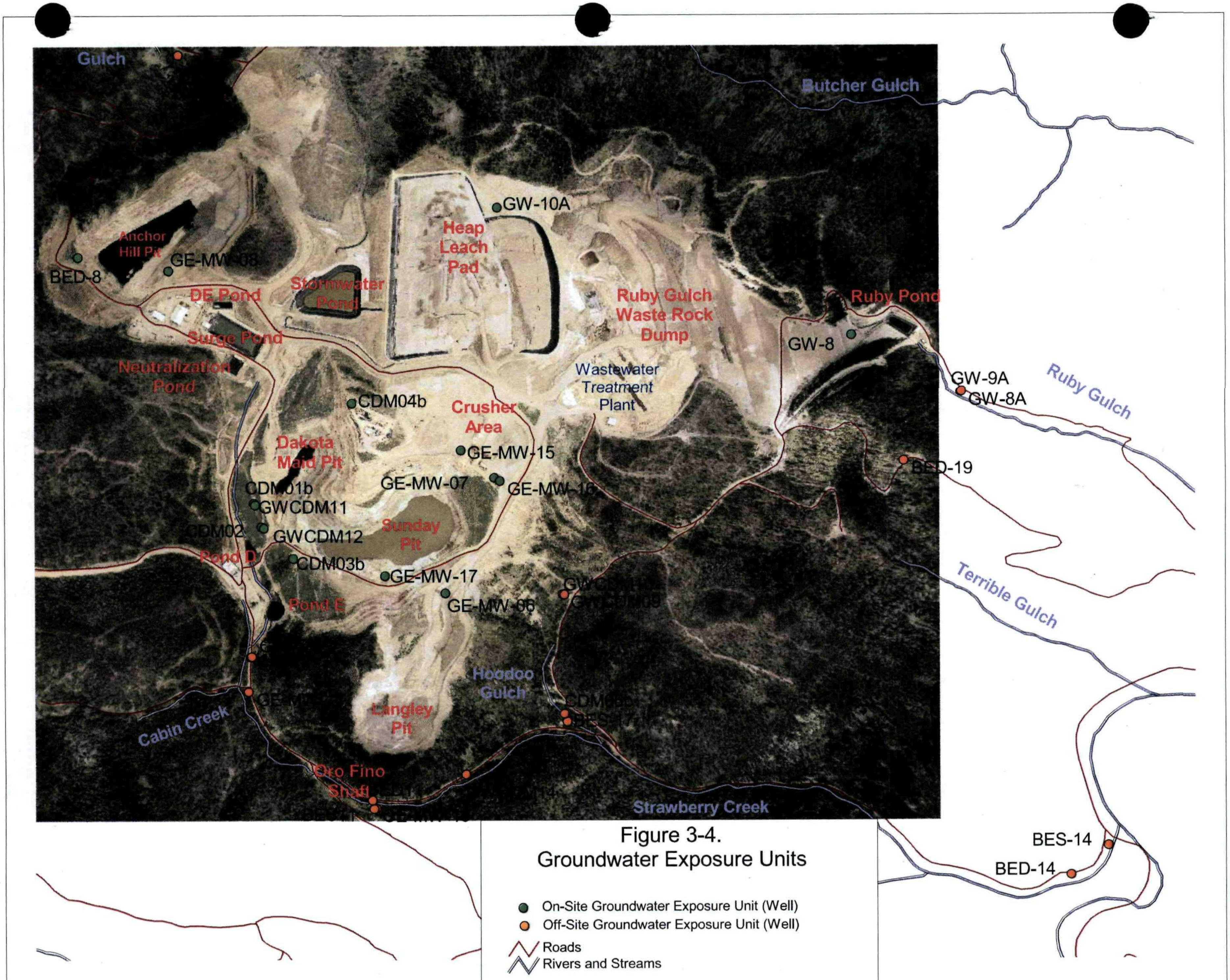


Figure 3-4.
Groundwater Exposure Units

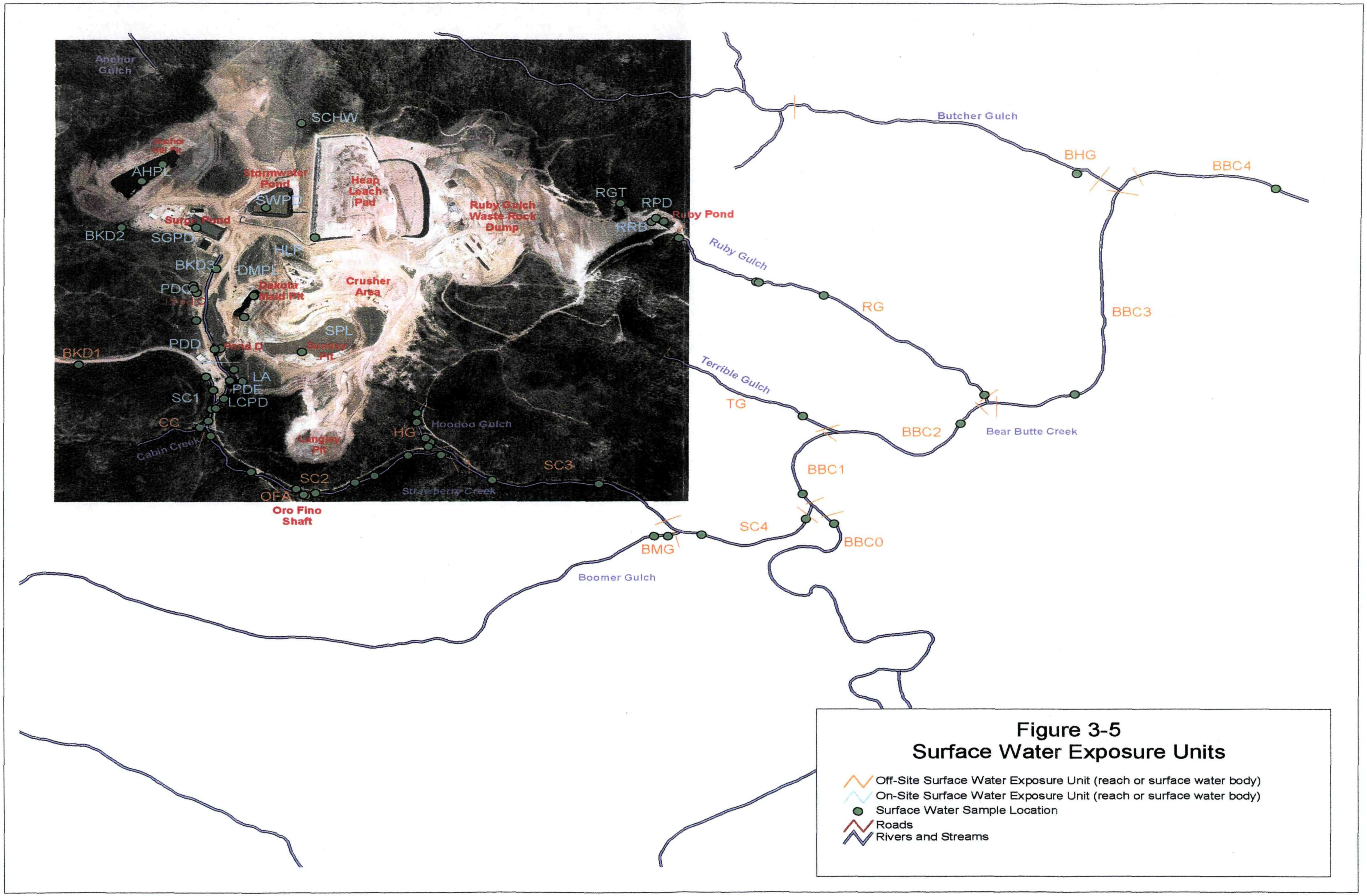


Figure 3-5
Surface Water Exposure Units

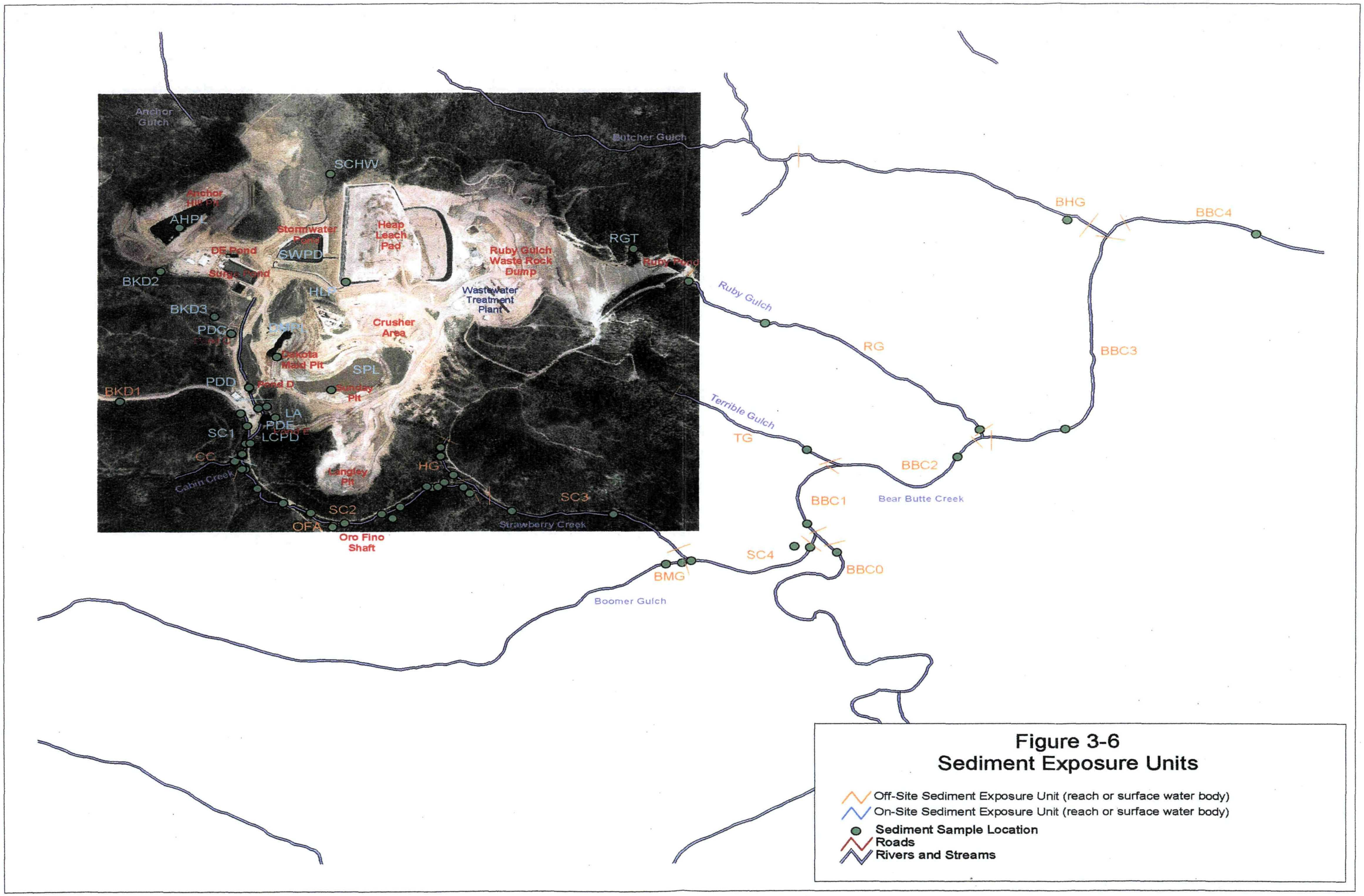


Figure 3-6
Sediment Exposure Units

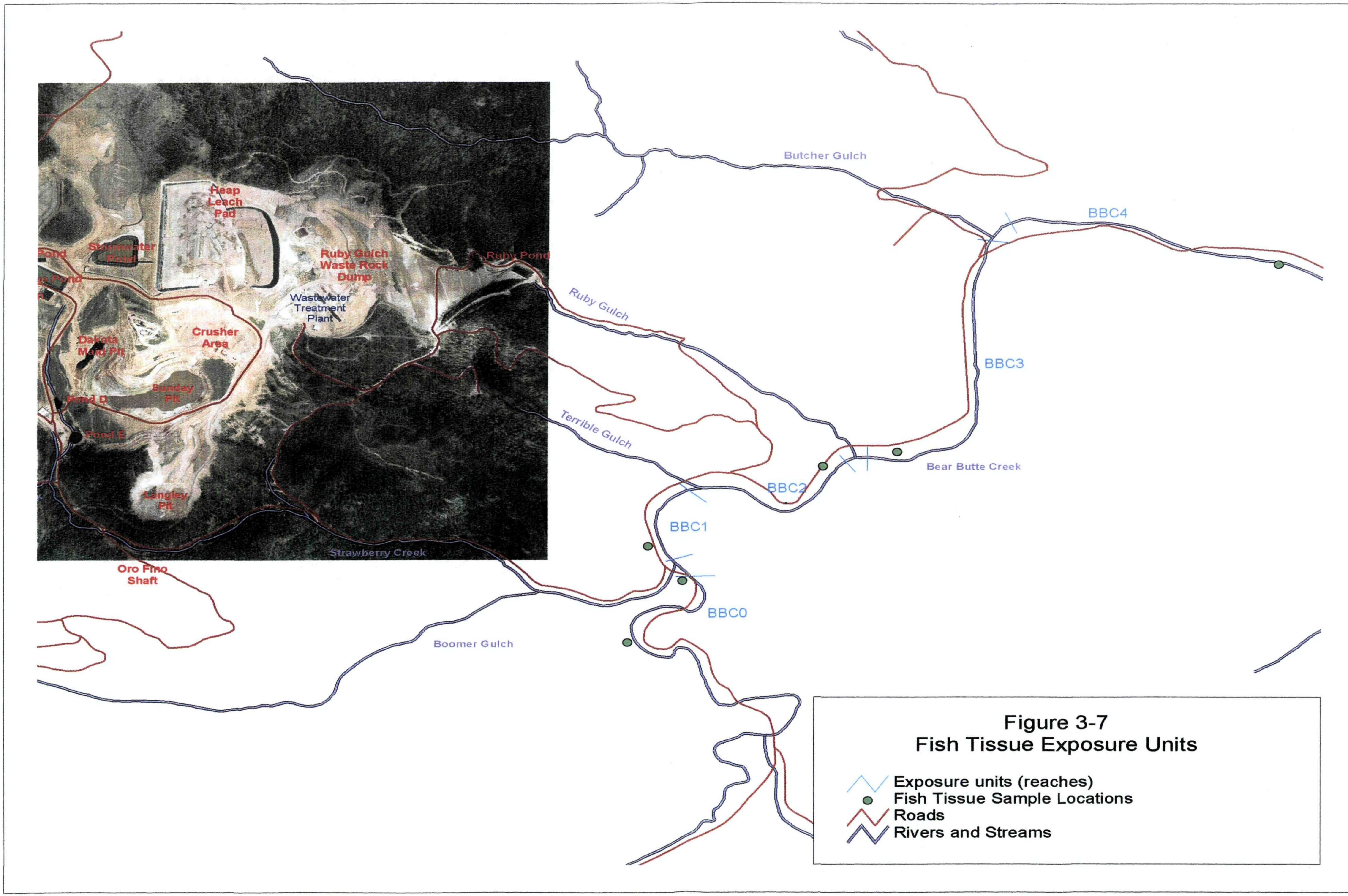


Figure 3-7
Fish Tissue Exposure Units

APPENDIX A

ELECTRONIC DATA

(ELECTRONIC DATABASE AVAILABLE UPON REQUEST)

APPENDIX B

SCREENING LEVEL EVALUATION OF INHALATION OF DUST EXPOSURE PATHWAY

SCREENING LEVEL EVALUATION OF THE INHALATION OF DUST EXPOSURE PATHWAY

This appendix presents a screening level evaluation of the inhalation of particulates in air exposure pathway identified in the conceptual site model to determine if this pathway requires further evaluation the risk assessment.

Basic Approach

The screening level approach is to quantify the dose of metals inhaled from particulates in air relative to the dose of metals ingested from soil.

The basic equation recommended by EPA (1989) for evaluation of inhalation exposure is:

$$DI_{air} = C_a \cdot BR_a \cdot EF \cdot ED/(BW \cdot AT)$$

where:

DI_{air}	=	Daily intake from air (mg/kg-d)
C_a	=	Concentration of substance in air (mg/m^3)
BR_a	=	Breathing rate of air (m^3/day)
EF	=	Exposure frequency (days/yr)
ED	=	Exposure duration (yrs)
BW	=	Body weight (kg)
AT	=	Averaging time (days)

and

$$C_a = k \cdot C_{soil}$$

where:

C_{soil}	=	Concentration of substance in soil (mg/kg)
k	=	soil to air transfer factor (kg/m^3)

The basic equation recommended by EPA (1989) for evaluation of soil ingestion is given by:

$$DI_{soil} = C_s \cdot IR_s \cdot EF \cdot ED/(BW \cdot AT)$$

where:

DI_{soil}	=	Daily intake from soil (mg/kg-d)

C_s = Concentration of substance in soil (mg/kg)
IR_s = Ingestion rate for soil (kg/day)
EF = Exposure frequency (days/yr)
ED = Exposure duration (yrs)
BW = Body weight (kg)
AT = Averaging time (days)

Based on the above equations, the relative magnitude of the inhaled dose of a COPC from air can be compared to the ingested dose from soil as follows:

$$\text{Ratio (inhalation / ingestion)} = k \cdot BR_d / IR_s$$

Values for these parameters for each of the receptors identified in the conceptual model are summarized in Table B-1.

Results

Table B-1 summarizes the ratio of the mass of soil inhaled to that ingested for each of the receptors identified in the conceptual model. As seen, the inhaled dose of soil from wind erosion is very small (<<1%) compared to the ingested dose, so the wind erosion pathway is not considered significant at this site.

The inhaled dose of soil from human disturbances (ATV riding, construction activities) is not insignificant (>1%) compared to the ingested dose. Thus, the inhalation of particulates exposure pathway from human disturbances is evaluated quantitatively for a recreational visitor (ATV rider) and a construction worker.

References

EPA. 1989. Risk Assessment Guidance for Superfund. Volume I: Human Health Evaluation Manual Part A. Interim Final. Office of Solid Waste and Emergency Response (OSWER), Washington, DC. OSWER Directive 9285.701A.

TABLE B-1. PATHWAY SCREENING
INHALATION OF PARTICULATES RELATIVE TO SOIL INGESTION

Basic Equation: $DI_{air}/DI_{soil} = k * BR_d/IR_s$

Air Source	Receptor	Input Parameters			Ratio	
		k (kg/m^3)	BR_d (m^3/day)	IRs (kg/day)	DI_{air}/DI_{soil}	DI_{air}/DI_{soil} (%)
wind erosion	Recreational Visitor (ATV Rider)	5.9E-09	3.6	1E-04	2E-04	0.02%
	Recreational Visitor (Hiker, adult)	5.9E-09	6.0	5E-05	7E-04	0.07%
	Recreational Visitor (Hiker, child)	5.9E-09	4.0	1E-04	2E-04	0.02%
	Construction Worker	5.9E-09	20	3E-04	4E-04	0.04%
	Commercial Worker	5.9E-09	20	1E-04	1E-03	0.12%
	Future Resident (adult)	5.9E-09	20	1E-04	1E-03	0.12%
	Child Resident	5.9E-09	15.4	2E-04	5E-04	0.05%
human disturbance	Recreational Visitor (ATV Rider)	1.0E-06	3.6	1E-04	4E-02	3.60%
	Construction Worker	2.9E-07	20	3E-04	2E-02	1.73%

Note: RME exposure parameters are used in the calculations

k = Particulate Emission Factor (PEF) (see Appendix E for derivation)
BR_d = Breathing rate of dust
IR_s = Soil Ingestion Rate
DI = Daily Intake (mg/kg-day)

APPENDIX C

SELECTION OF CHEMICALS OF POTENTIAL CONCERN (COPC)

C-1 – SOIL COPCS SELECTION
C-2 – SEDIMENT COPCS SELECTION
C-3 – SURFACE WATER COPCS SELECTION
C-4 – GROUNDWATER COPCS SELECTION
C-5 – FISH TISSUE COPCS SELECTION
C-6 – EVALUATION OF ESSENTIAL NUTRIENTS
C-7 – REGION III SCREENING LEVELS

Table C-1. Soil COPC Selection

CHEMICAL	DATA						COPC SELECTION STEPS					SOIL COPCs		
										Essential Nutrient				
	Detection Frequency	Max Concentration (mg/kg)	Essential Nutrient w/o Toxicity Data (Yes/No) [1]	Max Daily Dose (mg/day) [2]	Accepted Daily Dose (mg/day) [3]	Soil RBC (mg/kg) [4]	Does compound have a toxicity value?	Is Max Detect > RBC?	Is detection frequency ≥5%?	Is compound a non-toxic essential nutrient?	Does Max Dose >> Accepted Dose?	QUANT COPC	QUAL COPC	Not a COPC
Aluminum	100%	15,100	No	–	–	7,821	Yes	Yes	Yes	–	–	X		
Antimony	29%	12	No	–	–	3.1	Yes	Yes	Yes	–	–	X		
Arsenic	100%	1,435	No	–	–	0.43	Yes	Yes	Yes	–	–	X		
Barium	100%	886	No	–	–	1,564	Yes	No	–	–	–			X
Beryllium	86%	2.5	No	–	–	15.6	Yes	No	–	–	–			X
Bismuth	91%	250	No	–	–	–	No	–	–	No	–		X	
Cadmium	63%	17	No	–	–	7.8	Yes	Yes	Yes	–	–	X		
Calcium	100%	43,100	Yes	14.2	1000	–	No	–	–	Yes	No			X
Chromium	93%	261	No	–	–	23	Yes	Yes	Yes	–	–	X		
Cobalt	100%	56	No	–	–	156	Yes	No	–	–	–			X
Copper	100%	1,150	No	–	–	313	Yes	Yes	Yes	–	–	X		
Cyanide	34%	2.7	No	–	–	156	Yes	No	–	–	–			X
Iron	100%	148,100	No	–	–	2,346	Yes	Yes	Yes	–	–	X		
Lead	100%	3,738	No	–	–	400	Yes	Yes	Yes	–	–	X		
Magnesium	100%	8,350	Yes	2.8	400	–	No	–	–	Yes	No			X
Manganese	100%	10,000	No	–	–	1,095	Yes	Yes	Yes	–	–	X		
Mercury	40%	0.6	No	–	–	2.35	Yes	No	–	–	–			X
Molybdenum	100%	276	No	–	–	39	Yes	Yes	Yes	–	–	X		
Nickel	97%	165	No	–	–	156	Yes	Yes	Yes	–	–	X		
Phosphorus [5]	100%	3,150	Yes	0.33	1000	–	No	–	–	Yes	No			X
Potassium	100%	11,200	Yes	3.7	3500	–	No	–	–	Yes	No			X
Scandium	95%	5	No	–	–	–	No	–	–	No	–		X	
Selenium	40%	7.2	No	–	–	39	Yes	No	–	–	–			X
Silver	60%	21.6	No	–	–	39	Yes	No	–	–	–			X
Sodium	95%	5,700	Yes	1.9	2400	–	No	–	–	Yes	No			X
Strontium	100%	310	No	–	–	4,693	Yes	No	–	–	–			X
Thallium	32%	900	No	–	–	0.5	Yes	Yes	Yes	–	–	X		
Tin	0%	5	No	–	–	4,693	Yes	No	–	–	–			X
Tungsten	25%	10	No	–	–	–	No	–	–	No	–		X	
Vanadium	100%	97	No	–	–	7.8	Yes	Yes	Yes	–	–	X		
Ytrium	100%	44	No	–	–	–	No	–	–	No	–		X	
Zinc	100%	7,337	No	–	–	2,346	Yes	Yes	Yes	–	–	X		
Zirconium	100%	46	No	–	–	–	No	–	–	No	–		X	

[1] Based on USEPA 1994, Table 1. Chemicals identified by USEPA as essential nutrients for which toxicity data were not available were assigned a value of "Yes", whereas essential nutrients with toxicity data were assigned values of "No".

[2] Maximum expected dose for the maximally exposed receptor (resident), see Table C-6 for calculations.

[3] Values are either Reference Daily Intake (RDI) or Daily Reference Value (DRV). RDIs replace the term "U. S. Recommended Daily Allowances" (introduced in 1973 as a reference value for vitamins, minerals, and protein). DRVs are for nutrients for which no set of standards previously existed. Values obtained from http://www.fda.gov/fdac/special/foodlabel/dvs.html.

[4] RBC is Region III default soil screening level for residential soil, based on a target cancer risk of 1E-06 and a target noncancer Hazard Quotient of 0.1.

[5] Assumes all phosphorus is present as phosphate.

Table C-2. Sediment COPC Selection

CHEMICAL	DATA						COPC SELECTION STEPS			Essential Nutrient		SEDIMENT COPCs		
	Detection Frequency	Max Concentration (mg/kg)	Essential Nutrient w/o Toxicity Data (Yes/No) [1]	Max Daily Dose (mg/day) [2]	Accepted Daily Dose (mg/day) [3]	Sediment RBC (mg/kg) [4]	Does compound have a toxicity value?	Is Max Detect > RBC?	Is detection frequency ≥5%?	Is compound a non-toxic essential nutrient?	Does Max Dose >> Accepted Dose?	QUANT COPC	QUAL COPC	Not a COPC
Aluminum	100%	147,000	No	–	–	7,821	Yes	Yes	Yes	–	–	X		
Antimony	14%	80	No	–	–	3.1	Yes	Yes	Yes	–	–	X		
Arsenic	96%	1,190	No	–	–	0.43	Yes	Yes	Yes	–	–	X		
Barium	99%	513	No	–	–	1,564	Yes	No	–	–	–			X
Beryllium	83%	19.5	No	–	–	15.6	Yes	Yes	Yes	–	–	X		
Cadmium	80%	313	No	–	–	7.821	Yes	Yes	Yes	–	–	X		
Calcium	98%	215,000	Yes	10.8	1000	–	No	–	–	Yes	No			X
Chromium	100%	99	No	–	–	23.46	Yes	Yes	Yes	–	–	X		
Cobalt	97%	544	No	–	–	156	Yes	Yes	Yes	–	–	X		
Copper	100%	24,700	No	–	–	313	Yes	Yes	Yes	–	–	X		
Cyanide	50%	16	No	–	–	156	Yes	No	–	–	–			X
Iron	100%	244,000	No	–	–	2,346	Yes	Yes	Yes	–	–	X		
Lead	100%	2,120	No	–	–	400	Yes	Yes	Yes	–	–	X		
Magnesium	100%	42,500	Yes	2.1	400	–	No	–	–	Yes	No			X
Manganese	100%	15,400	No	–	–	1,095.00	Yes	Yes	Yes	–	–	X		
Mercury	38%	2	No	–	–	2	Yes	No	–	–	–			X
Nickel	99%	444.0	No	–	–	156.43	Yes	Yes	Yes	–	–	X		
Potassium	99%	7,710	Yes	0.4	3500	–	No	–	–	Yes	No			X
Selenium	44%	9	No	–	–	39	Yes	No	–	–	–			X
Silver	81%	22	No	–	–	39.11	Yes	No	–	–	–			X
Sodium	96%	33,300	Yes	1.7	2400	–	No	–	–	Yes	No			X
Thallium	22%	16	No	–	–	0.55	Yes	Yes	Yes	–	–	X		
Vanadium	98%	138.0	No	–	–	8	Yes	Yes	Yes	–	–	X		
Zinc	99%	7,360.0	No	–	–	2,346	Yes	Yes	Yes	–	–	X		

[1] Based on USEPA 1994, Table 1. Chemicals identified by USEPA as essential nutrients for which toxicity data were not available were assigned a value of "Yes", whereas essential nutrients with toxicity data were assigned values of "No".

[2] Maximum expected dose for the maximally exposed receptor (child hiker), see Table C-6 for calculations.

[3] Values are either Reference Daily Intake (RDI) or Daily Reference Value (DRV). RDIs replace the term "U. S. Recommended Daily Allowances" (introduced in 1973 as a reference value for vitamins, minerals, and protein). DRVs are for nutrients for which no set of standards previously existed. Values obtained from http://www.fda.gov/fdac/special/foodlabel/dvs.html.

[4] RBC is Region III default soil screening level for residential soil, based on a target cancer risk of 1E-06 and a target noncancer Hazard Quotient of 0.1.

Table C-3. Surface Water COPC Selection

CHEMICAL		DATA						COPC SELECTION STEPS					SURFACE WATER COPCs		
											Essential Nutrient				
		Detection Frequency	Max Concentration (ug/L)	Essential Nutrient w/o Toxicity Data (Yes/No) [1]	Max Daily Dose (mg/day) [2]	Accepted Daily Dose (mg/day) [3]	Surface Water RBC (ug/L) [4]	Does compound have a toxicity value?	Is Max Detect > RBC?	Is detection frequency ≥5%?	Is compound a non-toxic essential nutrient?	Does Max Dose >> Accepted Dose?	QUANT COPC	QUAL COPC	Not a COPC
Aluminum		70%	1,090,000	No	–	–	3,650	Yes	Yes	Yes	–	–	X		
Ammonia		#N/A	8,800	No	–	–	20.9	Yes	Yes	#N/A	–	–	#N/A		#N/A
Antimony		4%	110	No	–	–	1.46	Yes	Yes	No	–	–			X
Arsenic		33%	6,790	No	–	–	0.045	Yes	Yes	Yes	–	–	X		
Barium		89%	408	No	–	–	730	Yes	No	–	–	–			X
Beryllium		32%	86	No	–	–	7.3	Yes	Yes	Yes	–	–	X		
Boron		0%	50	No	–	–	730	Yes	No	–	–	–			X
Cadmium		57%	1,990	No	–	–	1.8	Yes	Yes	Yes	–	–	X		
Calcium		99%	1,500,000	Yes	67.5	1000	–	No	–	–	Yes	No			X
Chromium		33%	620	No	–	–	11.0	Yes	Yes	Yes	–	–	X		
Cobalt		76%	1,460	No	–	–	73.0	Yes	Yes	Yes	–	–	X		
Copper		70%	161,000	No	–	–	146.0	Yes	Yes	Yes	–	–	X		
Cr, Hex		0%	5.0	No	–	–	11.0	Yes	No	–	–	–			X
Cyanide		22%	40,200	No	–	–	73.0	Yes	Yes	Yes	–	–	X		
Gold		100%	250	No	–	–	–	No	–	–	No	–		X	
Iron		59%	1,840,000	No	–	–	1,095	Yes	Yes	Yes	–	–	X		
Lead		20%	100	No	–	–	15.0	Yes	Yes	Yes	–	–	X		
Lithium		100%	160	No	–	–	73.0	Yes	Yes	Yes	–	–	X		
Magnesium		98%	760,000	Yes	34.2	400	–	No	–	–	Yes	No			X
Manganese		90%	57,500	No	–	–	73	Yes	Yes	Yes	–	–	X		
Mercury		3%	6.3	No	–	–	1.1	Yes	Yes	No	–	–			X
Molybdenum		0%	5.0	No	–	–	18.3	Yes	No	–	–	–			X
Nickel		69%	2,190	No	–	–	73.0	Yes	Yes	Yes	–	–	X		
Nitrate		92%	391,000	No	–	–	5;840	Yes	Yes	Yes	–	–	X		
Nitrite		3%	182	No	–	–	365.0	Yes	No	–	–	–			X
Phosphorus	[5]	66%	3,100	Yes	0.04	1000	–	No	–	–	Yes	No			X
Potassium		95%	62,700	Yes	67.5	3500	–	No	–	–	Yes	No			X
Selenium		37%	298	No	–	–	18.3	Yes	Yes	Yes	–	–	X		
Silver		8%	210	No	–	–	18.25	Yes	Yes	Yes	–	–	X		
Sodium		98%	2,500,000	Yes	67.5	2400	–	No	–	–	Yes	No			X
Strontium		70%	2,850	No	–	–	2,190	Yes	Yes	Yes	–	–	X		
Thallium		15%	89	No	–	–	0.3	Yes	Yes	Yes	–	–	X		
Tin		0%	5	No	–	–	2,190	Yes	No	–	–	–			X
Titanium		0%	3	No	–	–	–	No	–	–	No	–		X	
Vanadium		12%	450	No	–	–	3.65	Yes	Yes	Yes	–	–	X		
Zinc		74%	41,400	No	–	–	1,095	Yes	Yes	Yes	–	–	X		

[1] Based on USEPA 1994, Table 1. Chemicals identified by USEPA as essential nutrients for which toxicity data were not available were assigned a value of "Yes", whereas essential nutrients with toxicity data were assigned values of "No".

[2] Maximum expected dose for the maximally exposed receptor (child hiker), see Table C-6 for calculations.

[3] Values are either Reference Daily Intake (RDI) or Daily Reference Value (DRV). RDIs replace the term "U. S. Recommended Daily Allowances" (introduced in 1973 as a reference value for vitamins, minerals, and protein). DRVs are for nutrients for which no set of standards previously existed. Values obtained from http://www.fda.gov/fdac/special/foodlabel/dvs.html.

[4] RBC is Region III default tap water screening level, based on a target cancer risk of 1E-06 and a target noncancer Hazard Quotient of 0.1.

[5] Assumes all phosphorus is present as phosphate.

Table C-4. Groundwater COPC Selection

CHEMICAL		DATA: Detection Frequency	DATA: Max Concentration (ug/L)	DATA: Essential Nutrient w/o Toxicity Data (Yes/No) [1]	DATA: Max Daily Dose (mg/day) [2]	DATA: Accepted Daily Dose (mg/day) [3]	DATA: Ground-water RBC (ug/L) [4]	COPC SELECTION STEPS: Does compound have a toxicity value?	COPC SELECTION STEPS: Is Max Detect > RBC?	COPC SELECTION STEPS: Is detection frequency ≥5%?	COPC SELECTION STEPS: Essential Nutrient: Is compound a non-toxic essential nutrient?	COPC SELECTION STEPS: Essential Nutrient: Does Max Dose >> Accepted Dose?	GROUNDWATER COPCs: QUANT COPC	GROUNDWATER COPCs: QUAL COPC	GROUNDWATER COPCs: Not a COPC
Aluminum		78%	932,000	No	–	–	3,650	Yes	Yes	Yes	–	–	X		
Ammonia		#N/A	35,000	No	–	–	20.9	Yes	Yes	#N/A	–	–	#N/A		#N/A
Antimony		6%	58	No	–	–	1.46	Yes	Yes	Yes	–	–	X		
Arsenic		48%	798	No	–	–	0.045	Yes	Yes	Yes	–	–	X		
Barium		91%	464	No	–	–	730	Yes	No	–	–	–			X
Beryllium		47%	59	No	–	–	7.3	Yes	Yes	Yes	–	–	X		
Cadmium		60%	1,090	No	–	–	1.8	Yes	Yes	Yes	–	–	X		
Calcium		100%	688,000	Yes	1,376	1,000	–	No	–	–	Yes	No			X
Chromium		44%	1,010	No	–	–	11.0	Yes	Yes	Yes	–	–	X		
Cobalt		66%	530	No	–	–	73.0	Yes	Yes	Yes	–	–	X		
Copper		71%	334,000	No	–	–	146.0	Yes	Yes	Yes	–	–	X		
Cyanide		13%	30	No	–	–	73.0	Yes	No	–	–	–			X
Iron		88%	1,730,000	No	–	–	1,095.0	Yes	Yes	Yes	–	–	X		
Lead		52%	2,400	No	–	–	15.0	Yes	Yes	Yes	–	–	X		
Magnesium		98%	460,000	Yes	920	400	–	No	–	–	Yes	No			X
Manganese		97%	93,900	No	–	–	73	Yes	Yes	Yes	–	–	X		
Mercury		9%	3	No	–	–	1.10	Yes	Yes	Yes	–	–	X		
Nickel		87%	2,030	No	–	–	73.0	Yes	Yes	Yes	–	–	X		
Nitrate		59%	19,600	No	–	–	5,840.0	Yes	Yes	Yes	–	–	X		
Nitrite		16%	650	No	–	–	365	Yes	Yes	Yes	–	–	X		
Phosphorus	[5]	13%	830	Yes	0.001	1,000	–	No	–	–	Yes	No			X
Potassium		98%	37,400	Yes	75	3,500	–	No	–	–	Yes	No			X
Selenium		12%	52	No	–	–	18.3	Yes	Yes	Yes	–	–	X		
Silver		12%	29	No	–	–	18	Yes	Yes	Yes	–	–	X		
Sodium		99%	1,020,000	Yes	2,040	2,400	–	No	–	–	Yes	No			X
Strontium		100%	870	No	–	–	2,190.0	Yes	No	–	–	–			X
Thallium		14%	60	No	–	–	0.26	Yes	Yes	Yes	–	–	X		
Vanadium		26%	859	No	–	–	3.65	Yes	Yes	Yes	–	–	X		
Zinc		88%	36,800	No	–	–	1,095	Yes	Yes	Yes	–	–	X		

[1] Based on USEPA 1994, Table 1. Chemicals identified by USEPA as essential nutrients for which toxicity data were not available were assigned a value of "Yes", whereas essential nutrients with toxicity data were assigned values of "No".

[2] Maximum expected dose for the maximally exposed receptor (adult resident), see Table C-6 for calculations.

[3] Values are either Reference Daily Intake (RDI) or Daily Reference Value (DRV). RDIs replace the term "U. S. Recommended Daily Allowances" (introduced in 1973 as a reference value for vitamins, minerals, and protein). DRVs are for nutrients for which no set of standards previously existed. Values obtained from http://www.fda.gov/fdac/special/foodlabel/dvs.html.

[4] RBC is Region III default tap water screening level, based on a target cancer risk of 1E-06 and a target noncancer Hazard Quotient of 0.1.

[5] Assumes all phosphorus is present as phosphate.

Table C-5. Fish Tissue COPC Selection

CHEMICAL	DATA						COPC SELECTION STEPS					FISH TISSUE COPCs		
										Essential Nutrient				
	Detection Frequency	Max Concentration (mg/kg ww)	Essential Nutrient w/o Toxicity Data (Yes/No) [1]	Max Daily Dose (mg/day) [2]	Accepted Daily Dose (mg/day) [3]	Fish Tissue RBC (mg/kg ww) [4]	Does compound have a toxicity value?	Is Max Detect > RBC?	Is detection frequency ≥5%?	Is compound a non-toxic essential nutrient?	Does Max Dose >> Accepted Dose?	QUANT COPC	QUAL COPC	Not a COPC
Aluminum	38%	164	No	–	–	135	Yes	Yes	Yes	–	–	X		
Antimony	0%	6	No	–	–	0.1	Yes	Yes	No	–	–			X
Arsenic	76%	1	No	–	–	0.00	Yes	Yes	Yes	–	–	X		
Barium	33%	20	No	–	–	27.037	Yes	No	–	–	–			X
Beryllium	0%	1	No	–	–	0	Yes	Yes	No	–	–			X
Cadmium	65%	1	No	–	–	0.1	Yes	Yes	Yes	–	–	X		
Calcium	98%	14,400	Yes	67.5	1000	–	No	–	–	Yes	No			X
Chromium	29%	24	No	–	–	0.4	Yes	Yes	Yes	–	–	X		
Cobalt	19%	5	No	–	–	2.7	Yes	Yes	Yes	–	–	X		
Copper	70%	4	No	–	–	5.4	Yes	No	–	–	–			X
Iron	84%	410	No	–	–	40.6	Yes	Yes	Yes	–	–	X		
Lead	78%	1.2	No	–	–	–	No	–	–	No	–		X	
Magnesium	100%	432	Yes	34.2	400	–	No	–	–	Yes	No			X
Manganese	98%	102	No	–	–	18.9	Yes	Yes	Yes	–	–	X		
Mercury	75%	0.1	No	–	–	0.01	Yes	Yes	Yes	–	–	X		
Nickel	6%	17	No	–	–	2.7	Yes	Yes	Yes	–	–	X		
Potassium	100%	3,825	Yes	67.5	3500	–	No	–	–	Yes	No			X
Selenium	100%	2	No	–	–	0.7	Yes	Yes	Yes	–	–	X		
Silver	0%	1	No	–	–	0.7	Yes	Yes	No	–	–			X
Sodium	97%	1,193	Yes	67.5	2400	–	No	–	–	Yes	No			X
Thallium	0%	1	No	–	–	0	Yes	Yes	No	–	–			X
Vanadium	0%	5	No	–	–	0.14	Yes	Yes	No	–	–			X
Zinc	100%	48	No	–	–	40.6	Yes	Yes	Yes	–	–	X		

[1] Based on USEPA 1994, Table 1. Chemicals identified by USEPA as essential nutrients for which toxicity data were not available were assigned a value of "Yes", whereas essential nutrients with toxicity data were assigned values of "No".

[2] Maximum expected dose for the maximally exposed receptor (recreational fisherman), see Table C-6 for calculations.

[3] Values are either Reference Daily Intake (RDI) or Daily Reference Value (DRV). RDIs replace the term "U. S. Recommended Daily Allowances" (introduced in 1973 as a reference value for vitamins, minerals, and protein). DRVs are for nutrients for which no set of standards previously existed. Values obtained from http://www.fda.gov/fdac/special/foodlabel/dvs.html.

[4] RBC is Region III default fish tissue screening level, based on a target cancer risk of 1E-06 and a target noncancer Hazard Quotient of 0.1.

Table C-6. Evaluation of Essential Nutrients

Media	Maximally Exposed Receptor	Essential Nutrient	Maximum Concentration (C_{max})		RME Intake Rate (IR)		Maximum Daily Intake [1] (mg/day)	Accepted Daily Intake [2] (mg/day)		Ratio
			value	units	value	units		value	Source	
Soil	Construction Worker	Calcium	43,100	mg/kg	330	mg/day	14	1000	RDI	0.01
		Magnesium	8,350	mg/kg	330	mg/day	3	400	RDI	0.007
		Phosphorus	3,150	mg/kg	330	mg/day	0.3	1000	RDI	0.0003
		Potassium	11,200	mg/kg	330	mg/day	4	3500	DRV	0.001
		Sodium	5,700	mg/kg	330	mg/day	2	2400	DRV	0.001
Sediment	Hiker (child)	Calcium	215,000	mg/kg	50	mg/day	10.8	1000	RDI	0.011
		Magnesium	42,500	mg/kg	50	mg/day	2.1	400	RDI	0.005
		Potassium	7,710	mg/kg	50	mg/day	0.4	3500	DRV	0.0001
		Sodium	33,300	mg/kg	50	mg/day	1.7	2400	DRV	0.0007
Surface Water	Hiker (child)	Calcium	1,500,000	ug/L	45	mL/day	67.5	1000	RDI	0.07
		Magnesium	760,000	ug/L	45	mL/day	34.2	400	RDI	0.1
		Phosphorus	3,100	ug/L	45	mL/day	0.04	1000	RDI	0.00004
		Potassium	62,700	ug/L	45	mL/day	68	3500	DRV	0.02
		Sodium	2,500,000	ug/L	45	mL/day	68	2400	DRV	0.03
Groundwater	Resident (adult)	Calcium	688,000	ug/L	2	L/day	1,376	1000	RDI	1.4
		Magnesium	460,000	ug/L	2	L/day	920	400	RDI	2.3
		Phosphorus	830	ug/L	2	L/day	0.0005	1000	RDI	0.000001
		Potassium	37,400	ug/L	2	L/day	74.8	3500	DRV	0.02
		Sodium	1,020,000	ug/L	2	L/day	2040	2400	DRV	0.9
Fish Tissue	Recreational Fisherman (adult)	Calcium	14,400	mg/kg ww	25	g/day	360	1000	RDI	0.4
		Magnesium	432	mg/kg ww	25	g/day	10.8	400	RDI	0.0
		Potassium	3,825	mg/kg ww	25	g/day	95.625	3500	DRV	0.03
		Sodium	1,193	mg/kg ww	25	g/day	29.835	2400	DRV	0.0

[1] Calculated from maximum concentration and RME intake rate for the maximally exposed receptor (highest intake rate).
Max Daily Intake = C_{max} * IR. Conversion factors applied (as necessary) to yield daily intake in units of mg/day. Phosphorus in environmental media assumed to be present as phosphate. Maximum site concentration converted to phosphorus by multiplying by 0.316 (mass phosphorus/mass of phosphate).

[2] Valies are Reference Daily Intake (RDI) or Daily Reference Value (DRV). RDIs replace the term "U. S. Recommended Daily Allowances" (introduced in 1973 as a reference value for vitamins, minerals, and protein). DRVs are for nutrients for which no set of standards previously existed. Values obtained from http://www.fda.gov/fdac/special/foodlabel/dvs.html.

Expected dose exceeds accepted dose by less than one order of magnitude.
Expected dose exceeds accepted dose by more than one order of magnitude.

Table C-7. Region III Screening Levels
(10/2005 update)

CHEMICAL	NOTE	BASIS (C/NC)	RESIDENTIAL SOIL (mg/kg)	TAP WATER (ug/L)	FISH TISSUE (mg/kg)	RESIDENTIAL SOIL (mg/kg)	TAP WATER (ug/L)	FISH TISSUE (mg/kg)
Aluminum	[1]	NC	7.82E+04	3.65E+04	1.35E+03	7.82E+03	3.65E+03	1.35E+02
Antimony	[2]	N	3.13E+01	1.46E+01	5.41E-01	3.13E+00	1.46E+00	5.41E-02
Arsenic	[2]	C	4.26E-01	4.46E-02	2.10E-03	4.26E-01	4.46E-02	2.10E-03
Barium	[2]	NC	1.56E+04	7.30E+03	2.70E+02	1.56E+03	7.30E+02	2.70E+01
Beryllium	[2]	N	1.56E+02	7 30E+01	2.70E+00	1.56E+01	7.30E+00	2.70E-01
Bismuth	[2]	–	–	–	–	–	–	–
Boron	[2]	N	1.56E+04	7.30E+03	2.70E+02	1.56E+03	7.30E+02	2.70E+01
Cadmium	[2, 3]	NC	7.82E+01	1.83E+01	1.35E+00	7.82E+00	1.83E+00	1.35E-01
Calcium	[2]	–	–	–	–	–	–	–
Chromium	[2, 4]	NC	2.35E+02	1.10E+02	4.06E+00	2.35E+01	1.10E+01	4.06E-01
Cobalt	[1]	NC	1.56E+03	7.30E+02	2.70E+01	1.56E+02	7.30E+01	2.70E+00
Copper	[2]	N	3.13E+03	1.46E+03	5.41E+01	3.13E+02	1.46E+02	5.41E+00
Cr, Hex	[2]	NC	2.35E+02	1.10E+02	4.06E+00	2.35E+01	1.10E+01	4.06E-01
Cyanide	[2]	NC	1.56E+03	7.30E+02	2.70E+01	1.56E+02	7.30E+01	2.70E+00
Gold	[2]	–	–	–	–	–	–	–
Iron	[2]	N	2.35E+04	1.10E+04	4.06E+02	2.35E+03	1.10E+03	4.06E+01
Lead	[2, 5, 6]	–	4.00E+02	1.50E+01	–	4.00E+02	1.50E+01	–
Lithium	[2]	N	1.56E+03	7.30E+02	2.70E+01	1.56E+02	7.30E+01	2.70E+00
Magnesium	[2]	–	–	–	–	–	–	–
Manganese	[2, 3]	NC	1.10E+04	7.30E+02	1.89E+02	1.10E+03	7.30E+01	1.89E+01
Mercury	[2, 7]	NC	2.35E+01	1.10E+01	1.35E-01	2.35E+00	1.10E+00	1.35E-02
Molybdenum	[2]	N	3.91E+02	1.83E+02	6.76E+00	3.91E+01	1.83E+01	6.76E-01
Nickel	[2]	N	1.56E+03	7.30E+02	2.70E+01	1.56E+02	7.30E+01	2.70E+00
Nitrate	[2]	N	1.25E+05	5.84E+04	2.16E+03	1.25E+04	5.84E+03	2.16E+02
Nitrite	[2]	N	7.82E+03	3.65E+03	1.35E+02	7.82E+02	3.65E+02	1.35E+01
Phosphorus	–	–	–	–	–	–	–	–
Potassium	[2]	–	–	–	–	–	–	–
Scandium	[2]	–	–	–	–	–	–	–
Selenium	[2]	N	3.91E+02	1.83E+02	6.76E+00	3.91E+01	1.83E+01	6.76E-01
Silver	[2]	N	3.91E+02	1.83E+02	6.76E+00	3.91E+01	1.83E+01	6.76E-01
Sodium	[2]	–	–	–	–	–	–	–
Strontium	[2]	NC	4 69E+04	2.19E+04	8.11E+02	4.69E+03	2.19E+03	8.11E+01
Thallium	[2]	N	5.48E+00	2.56E+00	9.46E-02	5.48E-01	2.56E-01	9.46E-03
Tin	[2]	N	4.69E+04	2.19E+04	8.11E+02	4.69E+03	2.19E+03	8.11E+01
Titanium	[2]	–	–	–	–	–	–	–
Tungsten	[2]	–	–	–	–	–	–	–
Vanadium	[2]	N	7.82E+01	3.65E+01	1.35E+00	7.82E+00	3.65E+00	1.35E-01
Ytrium	[2]	–	–	–	–	–	–	–
Zinc	[2]	N	2.35E+04	1.10E+04	4.06E+02	2.35E+03	1.10E+03	4.06E+01
Zirconium	[2]	–	–	–	–	–	–	–

[1] As cited in the Region III tables (April 2005). Toxicity values are being updated (as part of regular review) and not included in the 10/2005 update.

[2] As cited in the Region III tables (October 2005).

[3] Soil and fish RBCs are food-RBCs; groundwater and surface water RBCs are water-RBCs.

[4] RBC for chromium VI (most conservative).

[5] Region IX RBC.

[6] USEPA Primary MCL (action level) for lead in drinking water.

[7] RBCs are for mercuric chloride (soil, tap water) and methylmercury (fish tissue).

APPENDIX D - EXPOSURE POINT CONCENTRATIONS

D-1 – SURFACE SOIL EXPOSURE POINT CONCENTRATIONS
D-2 – SURFACE AND SUBSURFACE SOIL (COMBINED) EXPOSURE POINT CONCENTRATIONS
D-3 – ON-SITE SURFACE WATER EXPOSURE POINT CONCENTRATIONS
D-4 – ON-SITE SEDIMENT WATER EXPOSURE POINT CONCENTRATIONS
D-5 – ON-SITE GROUNDWATER EXPOSURE POINT CONCENTRATIONS (DISSOLVED FRACTION)
D-6 – ON-SITE GROUNDWATER EXPOSURE POINT CONCENTRATIONS (TOTAL FRACTION)
D-7 – OFF-SITE SURFACE WATER EXPOSURE POINT CONCENTRATIONS
D-8 – OFF-SITE SEDIMENT WATER EXPOSURE POINT CONCENTRATIONS
D-9 – OFF-SITE FISH TISSUE EXPOSURE POINT CONCENTRATIONS
D-10 – OFF-SITE GROUNDWATER EXPOSURE POINT CONCENTRATIONS (DISSOLVED FRACTION)
D-11 – ON-SITE GROUNDWATER EXPOSURE POINT CONCENTRATIONS (TOTAL FRACTION)

PROUCL OUTPUT FILES (ELECTRONIC FILES)

Table D-1. Surface Soil Exposure Point Concentrations

EXPOSURE UNIT	CHEMICAL	NUMBER OF SAMPLES	DETECTION FREQUENCY	CONCENTRATION (mg/kg)			DATA DISTRIBUTION	95th UCL METHOD		EXPOSURE POINT CONCENTRATION (mg/kg)
				MEAN	MAX	95th UCL				
AH&P	Aluminum	24	100%	8,361	15,100	9,429	normal	Student's-t UCL		9,429
	Antimony	24	25%	1	5	2	non-parametric	95% Chebyshev (Mean, Sd) UCL		2
	Arsenic	24	100%	127	1,400	223	lognormal	Use 95% Chebyshev (MVUE) UCL		223
	Cadmium	24	79%	2	17	3	gamma	Approximate Gamma UCL		3
	Chromium	24	100%	17	63	27	non-parametric	95% Chebyshev (Mean, Sd) UCL		27
	Copper	24	100%	128	407	167	gamma	Approximate Gamma UCL		167
	Iron	24	100%	43,313	148,100	52,143	gamma	Approximate Gamma UCL		52,143
	Lead	24	100%	342	NA	NA	NA	NA	[1]	342
	Manganese	24	100%	1,516	10,000	3,370	non-parametric	95% Chebyshev (Mean, Sd) UCL		3,370
	Molybdenum	5	100%	84	276	--	--	--		276
	Nickel	24	100%	8	13	9	normal	Student's-t UCL		9
	Thallium	24	38%	72	900	491	non-parametric	99% Chebyshev (Mean, Sd) UCL		491
	Vanadium	24	100%	26	45	28	lognormal	95% H-UCL	[2]	28
	Zinc	24	100%	554	7,337	1,865	non-parametric	95% Chebyshev (Mean, Sd) UCL		1,865
HLP	Aluminum	21	100%	5,200	10,600	5,963	normal	Student's t-UCL		5,963
	Antimony	21	81%	4	10	7	non-parameteric	95% Chebyshev (Mean, Sd) UCL		7
	Arsenic	21	100%	394	1,425	590	gamma	Approximate Gamma UCL		590
	Cadmium	21	14%	1	3	2	non-parameteric	99% Chebyshev (Mean, Sd) UCL		2
	Chromium	21	100%	100	199	124	normal	Student's t-UCL		124
	Copper	21	100%	432	1,150	1,249	non-parametric	99% Chebyshev (Mean, Sd) UCL		1,150
	Iron	21	100%	58,381	109,800	68,773	normal	Student's t-UCL		68,773
	Lead	21	100%	433	NA	NA	NA	NA	[1]	433
	Manganese	21	100%	592	1,900	928	gamma	Approximate Gamma UCL		928
	Molybdenum	16	100%	26	56	31	normal	Student's t-UCL		31
	Nickel	21	100%	14	36	17	gamma	Approximate Gamma UCL		17
	Thallium	21	76%	65	100	154	non-parametric	99% Chebyshev (Mean, Sd) UCL		100
	Vanadium	21	100%	23	50	28	gamma	Approximate Gamma UCL		28
	Zinc	21	100%	460	3,849	725	gamma	Approximate Gamma UCL		725
LP	Aluminum	10	100%	7,493	13,900	9,588	normal	student's t-UCL		9,588
	Antimony	10	40%	4	10	7	gamma	Approximate Gamma UCL		7
	Arsenic	10	100%	351	1,435	817	lognormal	95% Chebyshev (MVUE) UCL		817
	Cadmium	10	40%	1	2	2	non-parametric	95% Chebyshev (Mean, Sd) UCL		2
	Chromium	10	100%	114	256	170	normal	student's t-UCL		170
	Copper	10	100%	162	561	296	gamma	Approximate Gamma UCL		296
	Iron	10	100%	39,130	61,300	47,333	normal	student's t-UCL		47,333
	Lead	10	100%	716	NA	NA	NA	NA	[1]	716
	Manganese	10	100%	788	1,880	1,177	normal	student's t-UCL		1,177
	Molybdenum	6	100%	14	40	--	--	--		40
	Nickel	10	100%	23	114	69	non-parametric	95% Chebyshev (Mean, Sd) UCL		69
	Thallium	10	40%	196	800	918	gamma	Adjusted Gamma UCL		800
	Vanadium	10	100%	30	71	43	normal	Student's-t UCL		43
	Zinc	10	100%	391	1,914	1,155	non-parametric	95% Chebyshev (Mean, Sd) UCL		1,155

Table D-1. Surface Soil Exposure Point Concentrations

EXPOSURE UNIT	CHEMICAL	NUMBER OF SAMPLES	DETECTION FREQUENCY	CONCENTRATION (mg/kg)			DATA DISTRIBUTION	95th UCL METHOD		EXPOSURE POINT CONCENTRATION (mg/kg)
				MEAN	MAX	95th UCL				
PCA	Aluminum	45	100%	6,544	12,200	7,058	normal	Student's t-UCL		7,058
	Antimony	45	31%	2	5	5	non-parameteric	99% Chebyshev (Mean, Sd) UCL		5
	Arsenic	45	100%	110	495	180	non-parameteric	95% Chebyshev (Mean, Sd) UCL		180
	Cadmium	45	58%	1	4	2	non-parameteric	95% Chebyshev (Mean, Sd) UCL		2
	Chromium	45	100%	61	261	166	non-parameteric	99% Chebyshev (Mean, Sd) UCL		166
	Copper	45	100%	92	613	107	lognormal	95% H-UCL		107
	Iron	45	100%	33,233	70,000	36,485	gamma	Approximate Gamma UCL		36,485
	Lead	45	100%	173	NA	NA	NA	NA	[1]	173
	Manganese	45	100%	600	1,890	866	non-parameteric	95% Chebyshev (Mean, Sd) UCL		866
	Molybdenum	17	100%	29	196	45	gamma	Approximate Gamma UCL		45
	Nickel	45	100%	10	21	11	gamma	Approximate Gamma UCL		11
	Thallium	45	31%	52	300	177	non-parameteric	99% Chebyshev (Mean, Sd) UCL		177
	Vanadium	45	100%	24	55	26	non-parametric	Mod-t UCL (Adjusted for skewness)	[2]	26
	Zinc	45	100%	191	569	220	gamma	Approximate Gamma UCL		220
RGWRD	Aluminum	19	100%	6,887	10,300	7,270	gamma	Approximate Gamma UCL		7,270
	Antimony	19	5%	0.4	1.1	0.5	non-parametric	Mod-t UCL (Adjusted for skewness)	[2]	0.5
	Arsenic	19	100%	55	325	122	non-parameteric	95% Chebyshev (Mean, Sd) UCL		122
	Cadmium	19	100%	1	2	1	non-parameteric	95% Chebyshev (Mean, Sd) UCL		1.4
	Chromium	19	100%	10	13	2	non-parametric	Student's-t UCL	[2]	2
	Copper	30	100%	49	125	116	non-parameteric	99% Chebyshev (Mean, Sd) UCL		116
	Iron	19	100%	25,611	37,800	27,844	normal	Student's t-UCL		27,844
	Lead	19	100%	123	NA	NA	NA	NA	[1]	123
	Manganese	19	100%	822	2,270	1,050	gamma	Approximate Gamma UCL		1,050
	Molybdenum	0	0%	NA	NA	NA	NA	NA	[3]	NA
	Nickel	19	100%	9	12	10	normal	Student's t-UCL	[2]	10
	Thallium	19	0%	0.5	0.6	0.5	non-parametric	Mod-t UCL (Adjusted for skewness)	[2]	0.5
	Vanadium	19	100%	24	97	32	non-parametric	Mod-t UCL (Adjusted for skewness)	[2]	32
	Zinc	19	100%	139	630	192	non-parametric	Mod-t UCL (Adjusted for skewness)	[2]	192

NA = Not Applicable.
-- Due to sample size (less than 10), a 95th UCL was not calculated.

[1] Risks to lead are evaluated based on the mean concentration; a 95th UCL was not calculated.
[2] ProUCL recommended two different UCLs; the maximum value is presented.
[3] Chemical not analyzed in surface soil; no EPC for this chemical.

Table D-2. Surface and Subsurface Soil (Combined) Exposure Point Concentrations

EXPOSURE UNIT	CHEMICAL	NUMBER OF SAMPLES	DETECTION FREQUENCY	CONCENTRATION (mg/kg)			DATA DISTRIBUTION	95th UCL METHOD		EXPOSURE POINT CONCENTRATION (mg/kg)
				MEAN	MAX	95th UCL				
	Aluminum	38	100%	7,808	15,100	8,602	normal	Student's t-UCL		8,602
	Antimony	38	16%	1	5	2	non-parametric	95% Chebyshev (Mean, Sd) UCL		2
	Arsenic	38	100%	114	1,400	156	gamma	Approximate Gamma UCL		156
	Cadmium	38	84%	2	17	2	lognormal	95% H-UCL		2
	Chromium	38	87%	13	63	18	lognormal	95% H-UCL		18
	Copper	38	100%	121	461	150	gamma	Approximate Gamma UCL		150
AH&P	Iron	38	100%	40,166	148,100	46,551	gamma	Approximate Gamma UCL		46,551
	Lead	38	100%	292	NA	NA	NA	NA	[1]	292
	Manganese	38	100%	1,274	10,000	2,463	non-parametric	95% Chebyshev (Mean, Sd) UCL		2,463
	Molybdenum	5	100%	84	276	--	--	--		276
	Nickel	38	92%	7	13	8	normal	Student's-t UCL		8
	Thallium	38	24%	46	900	314	non-parametric	99% Chebyshev (Mean, Sd) UCL		314
	Vanadium	38	100%	24	45	26	normal	Student's-t UCL		26
	Zinc	38	100%	422	7,337	1,254	non-parametric	95% Chebyshev (Mean, Sd) UCL		1,254
	Aluminum	21	100%	5,200	10,600	5,963	normal	Student's-t UCL		5,963
	Antimony	21	81%	4	10	7	non-parametric	95% Chebyshev (Mean, Sd) UCL		7
	Arsenic	21	100%	394	1,425	590	gamma	Approximate Gamma UCL		590
	Cadmium	21	14%	1	3	2	non-parametric	99% Chebyshev (Mean, Sd) UCL		2
	Chromium	21	100%	100	199	124	normal	Student's-t UCL		124
	Copper	21	100%	432	1,150	1,249	non-parametric	99% Chebyshev (Mean, Sd) UCL		1,150
HLP	Iron	21	100%	58,381	109,800	68,773	normal	Student's-t UCL		68,773
	Lead	21	100%	433	NA	NA	NA	NA	[1]	433
	Manganese	21	100%	592	1,900	928	gamma	Approximate Gamma UCL		928
	Molybdenum	16	100%	26	56	31	normal	Student's-t UCL		31
	Nickel	21	100%	14	36	17	gamma	Approximate Gamma UCL		17
	Thallium	21	76%	65	100	154	non-parametric	99% Chebyshev (Mean, Sd) UCL		100
	Vanadium	21	100%	23	50	28	gamma	Approximate Gamma UCL		28
	Zinc	21	100%	460	3,849	725	gamma	Approximate Gamma UCL		725
	Aluminum	14	100%	6,394	13,900	8,127	normal	Student's-t UCL		8,127
	Antimony	14	36%	4	12	7	gamma	Approximate Gamma UCL		7
	Arsenic	14	100%	288	1,435	1,431	non-parametric	99% Chebyshev (Mean, Sd) UCL		1,431
	Cadmium	14	57%	1	2	2	non-parametric	95% Chebyshev (Mean, Sd) UCL		2
	Chromium	14	86%	84	256	334	non-parametric	99% Chebyshev (Mean, Sd) UCL		256
	Copper	14	100%	133	561	210	gamma	Approximate Gamma UCL		210
LP	Iron	14	100%	34,136	61,300	41,276	normal	Student's-t UCL		41,276
	Lead	14	100%	573	NA	NA	NA	NA	[1]	573
	Manganese	14	100%	703	1,880	985	normal	Student's-t UCL		985
	Molybdenum	6	100%	14	40	--	--	--		40
	Nickel	14	100%	18	114	36	lognormal	Use 95% Chebyshev (MVUE) UCL		36
	Thallium	14	29%	140	800	897	non-parametric	99% Chebyshev (Mean, Sd) UCL		800
	Vanadium	14	100%	26	71	37	gamma	Approximate Gamma UCL		37
	Zinc	14	100%	314	1,914	872	non-parametric	95% Chebyshev (Mean, Sd) UCL		872

Table D-2. Surface and Subsurface Soil (Combined) Exposure Point Concentrations

EXPOSURE UNIT	CHEMICAL	NUMBER OF SAMPLES	DETECTION FREQUENCY	CONCENTRATION (mg/kg)			DATA DISTRIBUTION	95th UCL METHOD		EXPOSURE POINT CONCENTRATION (mg/kg)
				MEAN	MAX	95th UCL				
PCA	Aluminum	60	100%	6,361	12,200	6,844	normal	Student's t-UCL		6,844
	Antimony	60	23%	2	5	3	non-parameteric	95% Chebyshev (Mean, Sd) UCL		3
	Arsenic	60	100%	109	495	167	non-parameteric	95% Chebyshev (Mean, Sd) UCL		167
	Cadmium	60	65%	1	6	2	non-parameteric	95% Chebyshev (Mean, Sd) UCL		2
	Chromium	60	92%	48	261	101	non-parameteric	97.5% Chebyshev (Mean, Sd) UCL		101
	Copper	60	100%	87	613	133	non-parameteric	95% Chebyshev (Mean, Sd) UCL		133
	Iron	60	100%	32,227	70,000	34,836	gamma	Approximate Gamma UCL		34,836
	Lead	60	100%	183	NA	NA	NA	NA	[1]	183
	Manganese	60	100%	662	2,560	800	gamma	Approximate Gamma UCL		800
	Molybdenum	17	100%	29	196	45	gamma	Approximate Gamma UCL		45
	Nickel	60	97%	9	21	10	normal	Student's t-UCL		10
	Thallium	60	23%	39	300	137	non-parameteric	99% Chebyshev (Mean, Sd) UCL		137
	Vanadium	60	100%	23	55	25	non-parametric	Mod-t UCL (Adjusted for skewness)	[2]	25
	Zinc	60	100%	194	802	273	non-parameteric	95% Chebyshev (Mean, Sd) UCL		273
RGWRD	Aluminum	30	100%	7,472	14,500	8,325	lognormal	95% H-UCL	[2]	8,325
	Antimony	30	20%	1.6	5.0	4.8	non-parametric	99% Chebyshev (Mean, Sd) UCL		4.8
	Arsenic	30	100%	83	325	153	non-parametric	95% Chebyshev (Mean, Sd) UCL		153
	Cadmium	30	70%	1	7	2	non-parametric	95% Chebyshev (Mean, Sd) UCL		2.1
	Chromium	30	100%	42	186	129	non-parametric	99% Chebyshev (Mean, Sd) UCL		129
	Copper	41	100%	72	250	173	non-parametric	99% Chebyshev (Mean, Sd) UCL		173
	Iron	30	100%	34,257	69,600	39,343	lognormal	95% H-UCL		39,343
	Lead	30	100%	130	NA	NA	NA	NA	[1]	130
	Manganese	30	100%	898	3,750	1,214	gamma	Approximate Gamma UCL		1,214
	Molybdenum	11	100%	13	32	17	normal	Student's-t UCL		17.4
	Nickel	30	100%	15	165	38	non-parametric	95% Chebyshev (Mean, Sd) UCL		38
	Thallium	30	30%	117.0	800.0	512.5	non-parametric	99% Chebyshev (Mean, Sd) UCL		512.5
	Vanadium	30	100%	28	97	34	non-parametric	Mod-t UCL (Adjusted for skewness)	[2]	34
	Zinc	30	100%	195	1,101	376	non-parametric	95% Chebyshev (Mean, Sd) UCL		376

NA = Not Applicable.

– Due to sample size (less than 10), a 95th UCL was not calculated.

[1] Risks to lead are evaluated based on the mean concentration; a 95th UCL was not calculated.
[2] ProUCL recommended more than 1 UCL; the maximum value is presented.

Table D-3. On-Site Surface Water Exposure Point Concentrations

EXPOSURE UNIT	CHEMICAL	NUMBER OF SAMPLES	DETECTION FREQUENCY	CONCENTRATION (ug/L)			DATA DISTRIBUTION	95th UCL METHOD		EXPOSURE POINT CONCENTRATION (ug/L)
				MEAN	MAX	95th UCL				
AHPL	Aluminum	118	93%	12,435	219,000	37,587	non-parameteric	99% Chebyshev (Mean, Sd) UCL		37,587
	Arsenic	130	32%	11	56	14	non-parameteric	95% Chebyshev (Mean, Sd) UCL		14
	Beryllium	116	25%	3	22	4	non-parameteric	95% Chebyshev (Mean, Sd) UCL		4
	Cadmium	140	85%	112	474	224	non-parameteric	99% Chebyshev (Mean, Sd) UCL		224
	Chromium	129	22%	5	30	8	non-parameteric	97.5% Chebyshev (Mean, Sd) UCL		8
	Cobalt	113	82%	209	767	333	non-parameteric	97.5% Chebyshev (Mean, Sd) UCL		333
	Copper	137	91%	3,925	77,700	11,252	non-parameteric	99% Chebyshev (Mean, Sd) UCL		11,252
	Cyanide	81	32%	17	290	48	non-parameteric	97.5% Chebyshev (Mean, Sd) UCL		48
	Iron	120	84%	1,460	12,200	2,480	non-parameteric	97.5% Chebyshev (Mean, Sd) UCL		2,480
	Lead	130	29%	11	100	NA	NA	NA	[2]	11
	Lithium	12	100%	93	160	114	normal	Student's t-UCL		114
	Manganese	117	95%	17,342	29,000	23,642	non-parameteric	99% Chebyshev (Mean, Sd) UCL		23,642
	Nickel	129	86%	134	612	215	non-parameteric	97.5% Chebyshev (Mean, Sd) UCL		215
	Nitrate	32	44%	7,086	53,900	37,516	non-parameteric	99% Chebyshev (Mean, Sd) UCL		37,516
	Selenium	142	48%	15	175	25	non-parameteric	97.5% Chebyshev (Mean, Sd) UCL		25
	Silver	136	15%	12	210	32	non-parameteric	97.5% Chebyshev (Mean, Sd) UCL		32
	Strontium	14	100%	2,444	2,850	2,636	non-parametric	Student's-t UCL	[3]	2,636
	Thallium	74	36%	13	42	22	non-parameteric	97.5% Chebyshev (Mean, Sd) UCL		22
	Vanadium	116	3%	7	26	11	non-parameteric	97.5% Chebyshev (Mean, Sd) UCL		11
	Zinc	134	90%	2,277	10,900	4,684	non-parameteric	99% Chebyshev (Mean, Sd) UCL		4,684
BKD2	Aluminum	1	100%	415	415	--	--	--		415
	Arsenic	1	0%	3	3	--	--	--		3
	Beryllium	1	0%	0	0	--	--	--		0
	Cadmium	1	0%	0	0	--	--	--		0
	Chromium	1	0%	0	0	--	--	--		0
	Cobalt	NA	NA	NA	NA	--	--	--	[1]	--
	Copper	1	100%	3	3	--	--	--		3
	Cyanide	1	0%	1	1	--	--	--		1
	Iron	1	100%	312	312	--	--	--		312
	Lead	1	0%	1	1	--	--	--	[2]	1
	Lithium	NA	NA	NA	NA	--	--	--	[1]	--
	Manganese	1	100%	12	12	--	--	--		12
	Nickel	1	0%	1	1	--	--	--		1
	Nitrate	NA	NA	NA	NA	--	--	--	[1]	--
	Selenium	1	0%	2	2	--	--	--		2
	Silver	1	0%	0	0	--	--	--		0
	Strontium	1	0%	150	150	--	--	--		150
	Thallium	1	0%	3	3	--	--	--		3
	Vanadium	1	0%	0	0	--	--	--		0
	Zinc	1	100%	10	10	--	--	--		10

Table D-3. On-Site Surface Water Exposure Point Concentrations

EXPOSURE UNIT	CHEMICAL	NUMBER OF SAMPLES	DETECTION FREQUENCY	CONCENTRATION (ug/L)			DATA DISTRIBUTION	95th UCL METHOD		EXPOSURE POINT CONCENTRATION (ug/L)
				MEAN	MAX	95th UCL				
DMPL	Aluminum	17	100%	304,588	489,000	353,973	normal	Student's t-UCL		353,973
	Arsenic	16	100%	2,206	6,790	3,181	gamma	Approximate Gamma UCL		3,181
	Beryllium	16	100%	16	27	19	normal	Student's t-UCL		19
	Cadmium	17	94%	321	532	383	normal	Student's t-UCL		383
	Chromium	16	100%	241	620	340	gamma	Approximate Gamma UCL		340
	Cobalt	NA	NA	NA	NA	--	--	--	[1]	--
	Copper	24	100%	54,367	127,000	146,973	non-parameteric	99% Chebyshev (Mean, Sd) UCL		127,000
	Cyanide	16	44%	13	66	29	lognormal	95% Chebyshev (MVUE) UCL		29
	Iron	18	100%	806,206	1,840,000	1,003,711	normal	Student's t-UCL		1,003,711
	Lead	17	53%	11	86	NA	NA	NA	[2]	11
	Lithium	NA	NA	NA	NA	--	--	--	[1]	--
	Manganese	16	100%	8,537	13,400	9,813	normal	Student's t-UCL		9,813
	Nickel	16	100%	626	1,120	743	normal	Student's t-UCL		743
	Nitrate	11	100%	11,165	19,300	14,122	normal	Student's t-UCL		14,122
	Selenium	7	71%	17	30	--	--	--		30
	Silver	16	6%	3	8	9	non-parameteric	99% Chebyshev (Mean, Sd) UCL		8
	Strontium	1	100%	940	940	--	--	--		940
	Thallium	7	43%	15	38	--	--	--		38
	Vanadium	7	100%	86	237	--	--	--		237
	Zinc	17	100%	6,172	10,400	7,153	normal	Student's t-UCL		7,153
HLP	Aluminum	14	100%	15,247	53,000	20,459	lognormal	95% H-UCL		20,459
	Arsenic	13	100%	71	578	495	non-parameteric	99% Chebyshev (Mean, Sd) UCL		495
	Beryllium	7	100%	4	9	--	--	--		9
	Cadmium	14	100%	236	552	284	gamma	Approximate Gamma UCL		284
	Chromium	13	92%	9	71	62	non-parameteric	99% Chebyshev (Mean, Sd) UCL		62
	Cobalt	NA	NA	NA	NA	--	--	--	[1]	--
	Copper	14	100%	6,773	17,000	8,383	gamma	Approximate Gamma UCL		8,383
	Cyanide	21	67%	19	53	25	gamma	Approximate Gamma UCL		25
	Iron	14	100%	9,149	61,900	18,840	lognormal	95% Chebyshev (MVUE) UCL		18,840
	Lead	14	36%	1	5	NA	NA	NA	[2]	1
	Lithium	NA	NA	NA	NA	--	--	--	[1]	--
	Manganese	6	100%	7,157	13,700	--	--	--		13,700
	Nickel	13	100%	226	404	258	gamma	Approximate Gamma UCL		258
	Nitrate	15	100%	207,933	314,000	236,442	normal	Student's t-UCL		236,442
	Selenium	14	100%	43	61	48	normal	Student's t-UCL		48
	Silver	13	0%	1	1	--	--	--		1
	Strontium	NA	NA	NA	NA	--	--	--	[1]	--
	Thallium	NA	NA	NA	NA	--	--	--	[1]	--
	Vanadium	NA	NA	NA	NA	--	--	--	[1]	--
	Zinc	14	100%	4,841	9,500	5,625	gamma	Approximate Gamma UCL		5,625

Table D-3. On-Site Surface Water Exposure Point Concentrations

EXPOSURE UNIT	CHEMICAL	NUMBER OF SAMPLES	DETECTION FREQUENCY	CONCENTRATION (ug/L)			DATA DISTRIBUTION	95th UCL METHOD		EXPOSURE POINT CONCENTRATION (ug/L)
				MEAN	MAX	95th UCL				
LCPD	Aluminum	2	100%	89,050	111,000	--	--	--		111,000
	Arsenic	2	50%	16	22	--	--	--		22
	Beryllium	2	100%	11	13	--	--	--		13
	Cadmium	2	100%	193	206	--	--	--		206
	Chromium	2	100%	20	30	--	--	--		30
	Cobalt	NA	NA	NA	NA	--	--	--	[1]	--
	Copper	2	100%	17,750	18,100	--	--	--		18,100
	Cyanide	2	0%	2	3	--	--	--		3
	Iron	2	100%	17,450	21,800	--	--	--		21,800
	Lead	2	50%	2	3	--	--	--	[2]	2
	Lithium	NA	NA	NA	NA	--	--	--	[1]	--
	Manganese	2	100%	8,405	8,960	--	--	--		8,960
	Nickel	2	100%	328	353	--	--	--		353
	Nitrate	NA	NA	NA	NA	--	--	--	[1]	--
	Selenium	2	50%	5	7	--	--	--		7
	Silver	2	0%	0	0	--	--	--		0
	Strontium	1	100%	540	540	--	--	--		540
	Thallium	2	50%	12	22	--	--	--		22
	Vanadium	2	0%	1	1	--	--	--		1
	Zinc	2	100%	5,160	5,170	--	--	--		5,170
PDC	Aluminum	11	100%	846	1,750	1,103	normal	Student's t-UCL		1,103
	Arsenic	6	0%	2	3	--	--	--		3
	Beryllium	6	17%	0	1	--	--	--		1
	Cadmium	11	91%	33	196	84	gamma	Approximate Gamma UCL		84
	Chromium	6	33%	1	1	--	--	--		1
	Cobalt	5	100%	12	19	--	--	--		19
	Copper	12	83%	54	186	111	gamma	Approximate Gamma UCL		111
	Cyanide	5	60%	6	13	--	--	--		13
	Iron	11	45%	203	1,260	529	gamma	Approximate Gamma UCL		529
	Lead	11	18%	1	2	NA	NA	NA	[2]	1
	Lithium	NA	NA	NA	NA	--	--	--	[1]	--
	Manganese	6	100%	771	2,850	--	--	--		2,850
	Nickel	6	83%	22	93	--	--	--		93
	Nitrate	NA	NA	NA	NA	--	--	--	[1]	--
	Selenium	6	33%	4	8	--	--	--		8
	Silver	6	0%	1	2	--	--	--		2
	Strontium	2	50%	460	770	--	--	--		770
	Thallium	6	0%	3	4	--	--	--		4
	Vanadium	6	50%	1	2	--	--	--		2
	Zinc	11	100%	542	1,860	1,101	gamma	Approximate Gamma UCL		1,101

Table D-3. On-Site Surface Water Exposure Point Concentrations

EXPOSURE UNIT	CHEMICAL	NUMBER OF SAMPLES	DETECTION FREQUENCY	CONCENTRATION (ug/L)			DATA DISTRIBUTION	95th UCL METHOD		EXPOSURE POINT CONCENTRATION (ug/L)
				MEAN	MAX	95th UCL				
PDD	Aluminum	7	100%	103,980	295,000	--	--	--		295,000
	Arsenic	7	86%	257	892	--	--	--		892
	Beryllium	7	86%	9	26	--	--	--		26
	Cadmium	7	100%	270	1,060	--	--	--		1,060
	Chromium	7	86%	42	103	--	--	--		103
	Cobalt	NA	NA	NA	NA	--	--	--	[1]	--
	Copper	7	100%	25,673	73,600	--	--	--		73,600
	Cyanide	7	43%	6	26	--	--	--		26
	Iron	8	100%	128,936	375,000	--	--	--		375,000
	Lead	7	43%	3	13	--	--	--	[2]	3
	Lithium	NA	NA	NA	NA	--	--	--	[1]	--
	Manganese	7	100%	8,211	28,300	--	--	--		28,300
	Nickel	7	100%	305	1,210	--	--	--		1,210
	Nitrate	NA	NA	NA	NA	--	--	--	[1]	--
	Selenium	7	71%	7	12	--	--	--		12
	Silver	7	43%	2	4	--	--	--		4
	Strontium	3	100%	790	990	--	--	--		990
	Thallium	7	14%	3	9	--	--	--		9
	Vanadium	7	71%	19	72	--	--	--		72
	Zinc	7	100%	5,943	22,200	--	--	--		22,200
PDE	Aluminum	7	100%	219,686	466,000	--	--	--		466,000
	Arsenic	7	86%	350	754	--	--	--		754
	Beryllium	7	100%	19	33	--	--	--		33
	Cadmium	7	100%	558	1,530	--	--	--		1,530
	Chromium	7	100%	55	110	--	--	--		110
	Cobalt	NA	NA	NA	NA	--	--	--	[1]	--
	Copper	8	100%	39,944	100,000	--	--	--		100,000
	Cyanide	6	17%	2	8	--	--	--		8
	Iron	8	100%	99,896	239,000	--	--	--		239,000
	Lead	7	100%	15	31	--	--	--	[2]	15
	Lithium	NA	NA	NA	NA	--	--	--	[1]	--
	Manganese	7	100%	19,400	51,000	--	--	--		51,000
	Nickel	7	100%	772	1,630	--	--	--		1,630
	Nitrate	NA	NA	NA	NA	--	--	--	[1]	--
	Selenium	7	43%	6	12	--	--	--		12
	Silver	7	14%	1	1	--	--	--		1
	Strontium	2	100%	962	1,000	--	--	--		1,000
	Thallium	7	14%	4	15	--	--	--		15
	Vanadium	7	43%	7	33	--	--	--		33
	Zinc	7	100%	12,790	30,900	--	--	--		30,900

Table D-3. On-Site Surface Water Exposure Point Concentrations

EXPOSURE UNIT	CHEMICAL	NUMBER OF SAMPLES	DETECTION FREQUENCY	CONCENTRATION (ug/L)			DATA DISTRIBUTION	95th UCL METHOD		EXPOSURE POINT CONCENTRATION (ug/L)
				MEAN	MAX	95th UCL				
RGT	Aluminum	2	100%	29	29	--	--	--		29
	Arsenic	2	0%	2	2	--	--	--		2
	Beryllium	2	0%	0	0	--	--	--		0
	Cadmium	2	0%	0	0	--	--	--		0
	Chromium	2	0%	0	0	--	--	--		0
	Cobalt	NA	NA	NA	NA	--	--	--	[1]	--
	Copper	2	0%	1	1	--	--	--		1
	Cyanide	2	0%	1	1	--	--	--		1
	Iron	3	67%	51	60	--	--	--		60
	Lead	2	0%	1	1	--	--	--	[2]	1
	Lithium	NA	NA	NA	NA	--	--	--	[1]	--
	Manganese	2	100%	15	15	--	--	--		15
	Nickel	2	0%	1	1	--	--	--		1
	Nitrate	NA	NA	NA	NA	--	--	--	[1]	--
	Selenium	2	0%	2	2	--	--	--		2
	Silver	2	0%	0	0	--	--	--		0
	Strontium	2	0%	150	150	--	--	--		150
	Thallium	2	0%	2	2	--	--	--		2
	Vanadium	2	0%	0	0	--	--	--		0
	Zinc	2	100%	21	21	--	--	--		21
RPD	Aluminum	7	100%	490,000	938,000	--	--	--		938,000
	Arsenic	6	100%	1,650	3,280	--	--	--		3,280
	Beryllium	6	100%	39	67	--	--	--		67
	Cadmium	7	100%	591	1,030	--	--	--		1,030
	Chromium	6	100%	199	356	--	--	--		356
	Cobalt	NA	NA	NA	NA	--	--	--	[1]	--
	Copper	7	100%	44,257	83,900	--	--	--		83,900
	Cyanide	5	40%	16	68	--	--	--		68
	Iron	8	100%	440,625	1,000,000	--	--	--		1,000,000
	Lead	7	86%	15	33	--	--	--	[2]	15
	Lithium	NA	NA	NA	NA	--	--	--	[1]	--
	Manganese	6	100%	27,500	50,300	--	--	--		50,300
	Nickel	6	100%	1,120	1,910	--	--	--		1,910
	Nitrate	2	100%	15,510	28,700	--	--	--		28,700
	Selenium	6	17%	2	5	--	--	--		5
	Silver	6	0%	0	1	--	--	--		1
	Strontium	2	100%	1,115	1,180	--	--	--		1,180
	Thallium	6	17%	7	30	--	--	--		30
	Vanadium	6	33%	6	20	--	--	--		20
	Zinc	7	100%	15,121	30,300	--	--	--		30,300

Table D-3. On-Site Surface Water Exposure Point Concentrations

EXPOSURE UNIT	CHEMICAL	NUMBER OF SAMPLES	DETECTION FREQUENCY	CONCENTRATION (ug/L)			DATA DISTRIBUTION	95th UCL METHOD		EXPOSURE POINT CONCENTRATION (ug/L)
				MEAN	MAX	95th UCL				
RRB	Aluminum	9	100%	683,444	1,090,000	--	--	--		1,090,000
	Arsenic	9	100%	2,255	4,840	--	--	--		4,840
	Beryllium	9	100%	42	66	--	--	--		66
	Cadmium	9	100%	737	1,160	--	--	--		1,160
	Chromium	9	100%	253	409	--	--	--		409
	Cobalt	NA	NA	NA	NA	--	--	--	[1]	--
	Copper	9	100%	59,289	99,000	--	--	--		99,000
	Cyanide	9	33%	4	14	--	--	--		14
	Iron	9	100%	520,889	1,060,000	--	--	--		1,060,000
	Lead	9	78%	12	34	--	--	--	[2]	12
	Lithium	NA	NA	NA	NA	--	--	--	[1]	--
	Manganese	9	100%	33,944	56,100	--	--	--		56,100
	Nickel	9	100%	1,330	2,020	--	--	--		2,020
	Nitrate	1	100%	26,000	26,000	--	--	--		26,000
	Selenium	9	22%	4	10	--	--	--		10
	Silver	9	0%	0	1	--	--	--		1
	Strontium	2	100%	980	1,040	--	--	--		1,040
	Thallium	9	22%	13	71	--	--	--		71
	Vanadium	9	44%	8	21	--	--	--		21
	Zinc	9	100%	18,629	34,000	--	--	--		34,000
SC1	Aluminum	22	82%	48,933	495,000	564,835	lognormal	99% Chebyshev (MVUE) UCL		495,000
	Arsenic	22	23%	126	1,950	1,038	non-parameteric	99% Chebyshev (Mean, Sd) UCL		1,038
	Beryllium	22	55%	4	32	21	non-parameteric	99% Chebyshev (Mean, Sd) UCL		21
	Cadmium	22	73%	108	1,240	272	gamma	Adjusted Gamma UCL		272
	Chromium	22	32%	37	619	319	non-parameteric	99% Chebyshev (Mean, Sd) UCL		319
	Cobalt	NA	NA	NA	NA	--	--	--	[1]	--
	Copper	21	95%	11,146	109,000	75,848	non-parameteric	99% Chebyshev (Mean, Sd) UCL		75,848
	Cyanide	22	27%	5	28	19	non-parameteric	99% Chebyshev (Mean, Sd) UCL		19
	Iron	24	67%	57,143	908,000	225,625	non-parameteric	95% Chebyshev (Mean, Sd) UCL		225,625
	Lead	22	45%	3	16	NA	NA	NA	[2]	3
	Lithium	NA	NA	NA	NA	--	--	--	[1]	--
	Manganese	22	95%	3,948	42,400	8,715	gamma	Adjusted Gamma UCL		8,715
	Nickel	22	77%	165	1,440	876	lognormal	97.5% Chebyshev (MVUE) UCL		876
	Nitrate	NA	NA	NA	NA	--	--	--	[1]	--
	Selenium	22	45%	7	32	14	non-parameteric	95% Chebyshev (Mean, Sd) UCL		14
	Silver	22	18%	1	5	2	non-parameteric	95% Chebyshev (Mean, Sd) UCL		2
	Strontium	10	70%	607	1,300	824	normal	Student's t-UCL		824
	Thallium	22	9%	4	22	8	non-parameteric	95% Chebyshev (Mean, Sd) UCL		8
	Vanadium	22	18%	16	293	149	non-parameteric	99% Chebyshev (Mean, Sd) UCL		149
	Zinc	22	100%	2,399	25,900	9,730	lognormal	97.5% Chebyshev (MVUE) UCL		9,730

Table D-3. On-Site Surface Water Exposure Point Concentrations

EXPOSURE UNIT	CHEMICAL	NUMBER OF SAMPLES	DETECTION FREQUENCY	CONCENTRATION (ug/L)			DATA DISTRIBUTION	95th UCL METHOD		EXPOSURE POINT CONCENTRATION (ug/L)
				MEAN	MAX	95th UCL				
SCHW	Aluminum	3	67%	394	924	--	--	--		924
	Arsenic	3	0%	1	2	--	--	--		2
	Beryllium	3	0%	0	0	--	--	--		0
	Cadmium	3	0%	0	0	--	--	--		0
	Chromium	3	33%	1	1	--	--	--		1
	Cobalt	NA	NA	NA	NA	--	--	--	[1]	--
	Copper	3	33%	2	5	--	--	--		5
	Cyanide	3	0%	2	3	--	--	--		3
	Iron	3	100%	457	964	--	--	--		964
	Lead	3	33%	1	2	--	--	--	[2]	1
	Lithium	NA	NA	NA	NA	--	--	--	[1]	--
	Manganese	3	67%	15	24	--	--	--		24
	Nickel	3	0%	1	1	--	--	--		1
	Nitrate	NA	NA	NA	NA	--	--	--	[1]	--
	Selenium	3	0%	2	2	--	--	--		2
	Silver	3	0%	1	1	--	--	--		1
	Strontium	1	0%	150	150	--	--	--		150
	Thallium	3	0%	3	4	--	--	--		4
	Vanadium	3	33%	1	1	--	--	--		1
	Zinc	3	100%	20	22	--	--	--		22
SGPD	Aluminum	14	100%	1,329	6,300	2,946	gamma	Approximate Gamma UCL		2,946
	Arsenic	12	75%	16	46	24	normal	Student's t-UCL		24
	Beryllium	4	25%	1	1	--	--	--		1
	Cadmium	14	93%	51	118	173	non-parameteric	99% Chebyshev (Mean, Sd) UCL		118
	Chromium	5	40%	1	2	--	--	--		2
	Cobalt	NA	NA	NA	NA	--	--	--	[1]	--
	Copper	14	100%	533	2,090	976	gamma	Approximate Gamma UCL		976
	Cyanide	16	88%	7,151	40,200	23,581	gamma	Adjusted Gamma UCL		23,581
	Iron	14	93%	1,121	5,980	6,432	lognormal	99% Chebyshev (MVUE) UCL		5,980
	Lead	8	50%	1	3	NA	NA	NA	[2]	1
	Lithium	NA	NA	NA	NA	--	--	--	[1]	--
	Manganese	10	100%	2,591	4,320	3,359	normal	Student's t-UCL		3,359
	Nickel	5	100%	98	104	--	--	--		104
	Nitrate	33	100%	165,772	391,000	344,182	non-parameteric	99% Chebyshev (Mean, Sd) UCL		344,182
	Selenium	11	100%	47	83	60	normal	Student's t-UCL		60
	Silver	5	20%	1	1	--	--	--		1
	Strontium	NA	NA	NA	NA	--	--	--	[1]	--
	Thallium	NA	NA	NA	NA	--	--	--	[1]	--
	Vanadium	NA	NA	NA	NA	--	--	--	[1]	--
	Zinc	14	100%	1,238	2,800	1,631	normal	Student's t-UCL		1,631

Table D-3. On-Site Surface Water Exposure Point Concentrations

EXPOSURE UNIT	CHEMICAL	NUMBER OF SAMPLES	DETECTION FREQUENCY	CONCENTRATION (ug/L)			DATA DISTRIBUTION	95th UCL METHOD		EXPOSURE POINT CONCENTRATION (ug/L)
				MEAN	MAX	95th UCL				
SPL	Aluminum	41	100%	245,922	603,000	356,841	non-parameteric	95% Chebyshev (Mean, Sd) UCL		356,841
	Arsenic	40	93%	511	1,250	1,135	non-parameteric	99% Chebyshev (Mean, Sd) UCL		1,135
	Beryllium	40	100%	23	50	33	non-parameteric	95% Chebyshev (Mean, Sd) UCL		33
	Cadmium	41	100%	583	1,720	898	non-parameteric	95% Chebyshev (Mean, Sd) UCL		898
	Chromium	40	98%	69	142	139	non-parameteric	99% Chebyshev (Mean, Sd) UCL		139
	Cobalt	NA	NA	NA	NA	--	--	--	[1]	--
	Copper	50	100%	51,641	161,000	70,445	gamma	Approximate Gamma UCL		70,445
	Cyanide	40	63%	278	5,000	2,007	non-parameteric	99% Chebyshev (Mean, Sd) UCL		2,007
	Iron	42	100%	237,636	559,000	306,123	gamma	Approximate Gamma UCL		306,123
	Lead	41	100%	33	88	NA	NA	NA	[2]	33
	Lithium	NA	NA	NA	NA	--	--	--	[1]	--
	Manganese	40	100%	22,058	57,500	32,856	non-parameteric	95% Chebyshev (Mean, Sd) UCL		32,856
	Nickel	40	100%	819	2,190	1,253	non-parameteric	95% Chebyshev (Mean, Sd) UCL		1,253
	Nitrate	33	100%	31,697	64,300	34,282	gamma	Approximate Gamma UCL		34,282
	Selenium	9	44%	6	13	--	--	--		13
	Silver	40	23%	3	10	9	non-parameteric	99% Chebyshev (Mean, Sd) UCL		9
	Strontium	2	100%	1,075	1,100	--	--	--		1,100
	Thallium	9	22%	5	23	--	--	--		23
	Vanadium	9	44%	4	12	--	--	--		12
	Zinc	41	100%	16,698	37,200	24,350	non-parameteric	95% Chebyshev (Mean, Sd) UCL		24,350
SWPD	Aluminum	18	94%	19,051	223,000	113,835	lognormal	99% Chebyshev (MVUE) UCL		113,835
	Arsenic	12	42%	11	59	22	gamma	Approximate Gamma UCL		22
	Beryllium	11	45%	3	27	12	lognormal	99% Chebyshev (MVUE) UCL		12
	Cadmium	19	89%	106	626	234	gamma	Adjusted Gamma UCL		234
	Chromium	12	50%	3	31	28	non-parameteric	99% Chebyshev (Mean, Sd) UCL		28
	Cobalt	7	100%	170	999	--	--	--		999
	Copper	14	100%	5,628	44,900	18,909	gamma	Adjusted Gamma UCL		18,909
	Cyanide	14	50%	11	26	18	gamma	Approximate Gamma UCL		18
	Iron	18	78%	5,523	33,500	15,424	gamma	Adjusted Gamma UCL		15,424
	Lead	19	26%	3	45	NA	NA	NA	[2]	3
	Lithium	NA	NA	NA	NA	--	--	--	[1]	--
	Manganese	11	100%	4,443	22,600	11,726	lognormal	95% Chebyshev (MVUE) UCL		11,726
	Nickel	12	83%	108	801	938	lognormal	99% Chebyshev (MVUE) UCL		801
	Nitrate	6	100%	65,595	119,000	--	--	--		119,000
	Selenium	13	77%	14	27	18	normal	Student's t-UCL		18
	Silver	12	0%	1	2	1	non-parameteric	95% Chebyshev (Mean, Sd) UCL		1
	Strontium	2	100%	1,585	2,240	--	--	--		2,240
	Thallium	7	14%	3	6	--	--	--		6
	Vanadium	7	14%	1	3	--	--	--		3
	Zinc	19	95%	2,218	13,800	10,688	non-parameteric	99% Chebyshev (Mean, Sd) UCL		10,688

NA = Not Applicable.
-- Due to sample size (less than 10), a 95th UCL was not calculated.

[1] Chemical not analyzed in surface water; no EPC for this chemical.
[2] Risks to lead are evaluated based on the mean concentration; a 95th UCL was not calculated.
[3] ProUCL recommended two different UCLs; the maximum value is presented.

Table D-4. On-Site Sediment Exposure Point Concentrations

EXPOSURE UNIT	CHEMICAL	NUMBER OF SAMPLES	DETECTION FREQUENCY	CONCENTRATION (mg/kg)			DATA DISTRIBUTION	95th UCL METHOD		EXPOSURE POINT CONCENTRATION (mg/kg)
				MEAN	MAX	95th UCL				
AHPL	Aluminum	8	100%	89,869	147,000	--	--	--		147,000
	Antimony	8	0%	18	62	--	--	--		62
	Arsenic	8	100%	36	79	--	--	--		79
	Beryllium	8	100%	12	20	--	--	--		20
	Cadmium	8	100%	124	225	--	--	--		225
	Chromium	8	100%	19	44	--	--	--		44
	Cobalt	8	100%	255	432	--	--	--		432
	Copper	8	100%	13,817	22,700	--	--	--		22,700
	Iron	8	100%	28,921	80,500	--	--	--		80,500
	Lead	8	100%	76	135	NA	NA	NA	[1]	76
	Manganese	8	100%	7,215	12,000	--	--	--		12,000
	Nickel	8	100%	180	307	--	--	--		307
	Thallium	8	0%	6	13	--	--	--		13
	Vanadium	8	100%	19	26	--	--	--		26
	Zinc	8	100%	3,603	6,190	--	--	--		6,190
BKD2	Aluminum	1	100%	13,500	13,500	--	--	--		13,500
	Antimony	1	0%	1	1	--	--	--		1
	Arsenic	1	100%	20	20	--	--	--		20
	Beryllium	1	100%	2	2	--	--	--		2
	Cadmium	1	100%	1	1	--	--	--		1
	Chromium	1	100%	15	15	--	--	--		15
	Cobalt	1	100%	5	5	--	--	--		5
	Copper	1	100%	39	39	--	--	--		39
	Iron	1	100%	16,600	16,600	--	--	--		16,600
	Lead	1	100%	37	37	NA	NA	NA	[1]	37
	Manganese	1	100%	506	506	--	--	--		506
	Nickel	1	100%	17	17	--	--	--		17
	Thallium	1	0%	1	1	--	--	--		1
	Vanadium	1	100%	26	26	--	--	--		26
	Zinc	1	100%	106	106	--	--	--		106

Table D-4. On-Site Sediment Exposure Point Concentrations

EXPOSURE UNIT	CHEMICAL	NUMBER OF SAMPLES	DETECTION FREQUENCY	CONCENTRATION (mg/kg)			DATA DISTRIBUTION	95th UCL METHOD		EXPOSURE POINT CONCENTRATION (mg/kg)
				MEAN	MAX	95th UCL				
BKD3	Aluminum	1	100%	7,070	7,070	--	--	--		7,070
	Antimony	1	100%	1	1	--	--	--		1
	Arsenic	1	100%	54	54	--	--	--		54
	Beryllium	1	100%	1	1	--	--	--		1
	Cadmium	1	100%	1	1	--	--	--		1
	Chromium	1	100%	13	13	--	--	--		13
	Cobalt	1	100%	5	5	--	--	--		5
	Copper	1	100%	104	104	--	--	--		104
	Iron	1	100%	46,300	46,300	--	--	--		46,300
	Lead	1	100%	47	47	NA	NA	NA	[1]	47
	Manganese	1	100%	495	495	--	--	--		495
	Nickel	1	100%	10	10	--	--	--		10
	Thallium	1	0%	0	0	--	--	--		0
	Vanadium	1	100%	24	24	--	--	--		24
	Zinc	1	100%	137	137	--	--	--		137
DMPL	Aluminum	2	100%	3,050	4,990	--	--	--		4,990
	Antimony	2	0%	1	2	--	--	--		2
	Arsenic	2	100%	675	1,190	--	--	--		1,190
	Beryllium	2	0%	0	0	--	--	--		0
	Cadmium	2	50%	0	1	--	--	--		1
	Chromium	2	100%	25	48	--	--	--		48
	Cobalt	2	50%	3	6	--	--	--		6
	Copper	2	100%	201	226	--	--	--		226
	Iron	2	100%	112,600	191,000	--	--	--		191,000
	Lead	2	100%	88	93	NA	NA	NA	[1]	88
	Manganese	2	100%	28	44	--	--	--		44
	Nickel	2	100%	5	5	--	--	--		5
	Thallium	2	0%	1	1	--	--	--		1
	Vanadium	2	100%	35	65	--	--	--		65
	Zinc	2	100%	42	47	--	--	--		47

Table D-4. On-Site Sediment Exposure Point Concentrations

EXPOSURE UNIT	CHEMICAL	NUMBER OF SAMPLES	DETECTION FREQUENCY	CONCENTRATION (mg/kg)			DATA DISTRIBUTION	95th UCL METHOD		EXPOSURE POINT CONCENTRATION (mg/kg)
				MEAN	MAX	95th UCL				
HLP	Aluminum	3	100%	51,633	104,000	--	--	--		104,000
	Antimony	3	0%	7	18	--	--	--		18
	Arsenic	3	100%	38	52	--	--	--		52
	Beryllium	3	100%	3	5	--	--	--		5
	Cadmium	3	100%	14	32	--	--	--		32
	Chromium	3	100%	17	26	--	--	--		26
	Cobalt	3	100%	61	116	--	--	--		116
	Copper	3	100%	3,733	8,130	--	--	--		8,130
	Iron	3	100%	21,787	31,100	--	--	--		31,100
	Lead	3	100%	55	86	NA	NA	NA	[1]	55
	Manganese	3	100%	1,427	2,000	--	--	--		2,000
	Nickel	3	100%	65	108	--	--	--		108
	Thallium	3	0%	2	4	--	--	--		4
	Vanadium	3	100%	26	38	--	--	--		38
	Zinc	3	100%	1,282	2,490	--	--	--		2,490
PDC	Aluminum	1	100%	10,000	10,000	--	--	--		10,000
	Antimony	1	0%	1	1	--	--	--		1
	Arsenic	1	100%	65	65	--	--	--		65
	Beryllium	1	100%	4	4	--	--	--		4
	Cadmium	1	100%	38	38	--	--	--		38
	Chromium	1	100%	8	8	--	--	--		8
	Cobalt	1	100%	21	21	--	--	--		21
	Copper	1	100%	389	389	--	--	--		389
	Iron	1	100%	27,800	27,800	--	--	--		27,800
	Lead	1	100%	85	85	NA	NA	NA	[1]	85
	Manganese	1	100%	1,910	1,910	--	--	--		1,910
	Nickel	1	100%	49	49	--	--	--		49
	Thallium	1	0%	1	1	--	--	--		1
	Vanadium	1	100%	13	13	--	--	--		13
	Zinc	1	100%	1,430	1,430	--	--	--		1,430

Table D-4. On-Site Sediment Exposure Point Concentrations

EXPOSURE UNIT	CHEMICAL	NUMBER OF SAMPLES	DETECTION FREQUENCY	CONCENTRATION (mg/kg)			DATA DISTRIBUTION	95th UCL METHOD		EXPOSURE POINT CONCENTRATION (mg/kg)
				MEAN	MAX	95th UCL				
PDD	Aluminum	3	100%	9,490	11,200	–	–	–		11,200
	Antimony	3	0%	2	4	–	–	–		4
	Arsenic	3	100%	466	680	–	–	–		680
	Beryllium	3	67%	1	1	–	–	–		1
	Cadmium	3	67%	1	2	–	–	–		2
	Chromium	3	100%	19	25	–	–	–		25
	Cobalt	3	100%	6	8	–	–	–		8
	Copper	3	100%	337	389	–	–	–		389
	Iron	3	100%	96,367	128,000	–	–	–		128,000
	Lead	3	100%	331	442	NA	NA	NA	[1]	331
	Manganese	3	100%	170	236	–	–	–		236
	Nickel	3	100%	8	10	–	–	–		10
	Thallium	3	0%	1	1	–	–	–		1
	Vanadium	3	100%	46	62	–	–	–		62
	Zinc	3	100%	278	361	–	–	–		361
RGT	Aluminum	1	100%	8,230	8,230	–	–	–		8,230
	Antimony	1	0%	3	3	–	–	–		3
	Arsenic	1	100%	89	89	–	–	–		89
	Beryllium	1	100%	1	1	–	–	–		1
	Cadmium	1	0%	0	0	–	–	–		0
	Chromium	1	100%	11	11	–	–	–		11
	Cobalt	1	100%	5	5	–	–	–		5
	Copper	1	100%	25	25	–	–	–		25
	Iron	1	100%	26,800	26,800	–	–	–		26,800
	Lead	1	100%	39	39	NA	NA	NA	[1]	39
	Manganese	1	100%	228	228	–	–	–		228
	Nickel	1	100%	10	10	–	–	–		10
	Thallium	1	0%	1	1	–	–	–		1
	Vanadium	1	100%	21	21	–	–	–		21
	Zinc	1	100%	70	70	–	–	–		70

Table D-4. On-Site Sediment Exposure Point Concentrations

EXPOSURE UNIT	CHEMICAL	NUMBER OF SAMPLES	DETECTION FREQUENCY	CONCENTRATION (mg/kg)			DATA DISTRIBUTION	95th UCL METHOD		EXPOSURE POINT CONCENTRATION (mg/kg)
				MEAN	MAX	95th UCL				
SC1	Aluminum	20	100%	23,848	103,000	50,693	lognormal	95% Chebyshev (MVUE) UCL		50,693
	Antimony	20	15%	2	6	3	gamma	Approximate Gamma UCL		3
	Arsenic	20	100%	136	556	186	gamma	Approximate Gamma UCL		186
	Beryllium	20	90%	2	9	3	gamma	Approximate Gamma UCL		3
	Cadmium	20	85%	20	313	38	lognormal	95% Chebyshev (MVUE) UCL		38
	Chromium	20	100%	14	46	19	gamma	Approximate Gamma UCL		19
	Cobalt	20	95%	48	544	106	gamma	Adjusted Gamma UCL		106
	Copper	20	100%	2,676	24,700	15,936	non-parameteric	9% Chebyshev (Mean, Sd) UC		15,936
	Iron	20	100%	40,915	89,600	50,744	gamma	Approximate Gamma UCL		50,744
	Lead	20	100%	118	199	NA	NA	NA	[1]	118
	Manganese	20	100%	1,131	9,560	2,039	gamma	Approximate Gamma UCL		2,039
	Nickel	20	100%	55	444	290	non-parameteric	9% Chebyshev (Mean, Sd) UC		290
	Thallium	20	20%	2	5	2	gamma	Approximate Gamma UCL		2
	Vanadium	20	95%	25	43	29	normal	Student's t-UCL		29
	Zinc	20	100%	800	7,360	1,877	lognormal	95% Chebyshev (MVUE) UCL		1,877
SCHW	Aluminum	1	100%	9,980	9,980	–	–	–		9,980
	Antimony	1	0%	0	0	–	–	–		0
	Arsenic	1	100%	25	25	–	–	–		25
	Beryllium	1	100%	1	1	–	–	–		1
	Cadmium	1	0%	0	0	–	–	–		0
	Chromium	1	100%	12	12	–	–	–		12
	Cobalt	1	100%	11	11	–	–	–		11
	Copper	1	100%	69	69	–	–	–		69
	Iron	1	100%	27,900	27,900	–	–	–		27,900
	Lead	1	100%	41	41	NA	NA	NA	[1]	41
	Manganese	1	100%	1,040	1,040	–	–	–		1,040
	Nickel	1	100%	11	11	–	–	–		11
	Thallium	1	0%	1	1	–	–	–		1
	Vanadium	1	100%	24	24	–	–	–		24
	Zinc	1	100%	117	117	–	–	–		117

Table D-4. On-Site Sediment Exposure Point Concentrations

EXPOSURE UNIT	CHEMICAL	NUMBER OF SAMPLES	DETECTION FREQUENCY	CONCENTRATION (mg/kg)			DATA DISTRIBUTION	95th UCL METHOD		EXPOSURE POINT CONCENTRATION (mg/kg)
				MEAN	MAX	95th UCL				
SPL	Aluminum	3	100%	29,837	72,500	--	--	--		72,500
	Antimony	3	0%	2	3	--	--	--		3
	Arsenic	3	100%	791	1,150	--	--	--		1,150
	Beryllium	3	100%	2	5	--	--	--		5
	Cadmium	3	67%	4	7	--	--	--		7
	Chromium	3	100%	53	99	--	--	--		99
	Cobalt	3	67%	3	5	--	--	--		5
	Copper	3	100%	1,150	2,040	--	--	--		2,040
	Iron	3	100%	196,333	244,000	--	--	--		244,000
	Lead	3	100%	81	120	NA	NA	NA	[1]	81
	Manganese	3	100%	141	192	--	--	--		192
	Nickel	3	100%	7	8	--	--	--		8
	Thallium	3	33%	2	4	--	--	--		4
	Vanadium	3	100%	24	26	--	--	--		26
	Zinc	3	100%	124	155	--	--	--		155

NA = Not Applicable.
-- Due to sample size (less than 10), a 95th UCL was not calculated.

[1] Risks to lead are evaluated based on the mean concentration; a 95th UCL was not calculated.

Table D-5. On-Site Groundwater Exposure Point Concentrations
(Dissolved Fraction)

EXPOSURE UNIT	CHEMICAL	NUMBER OF SAMPLES	DETECTION FREQUENCY	CONCENTRATION (ug/L) MEAN	MAX	95th UCL	DATA DISTRIBUTION	95th UCL METHOD		EXPOSURE POINT CONCENTRATION (ug/L)
BED-8	Aluminum	8	25%	40	100	–	–	–		100
	Antimony	5	0%	8	30	–	–	–		30
	Arsenic	5	0%	3	8	–	–	–		8
	Beryllium	5	0%	1	3	–	–	–		3
	Cadmium	8	0%	1	3	–	–	–		3
	Chromium	5	0%	1	5	–	–	–		5
	Cobalt	5	0%	6	25	–	–	–		25
	Copper	8	0%	3	13	–	–	–		13
	Iron	8	13%	35	84	–	–	–		84
	Lead	8	0%	1	5	–	–	–	[2]	1
	Manganese	5	100%	1,062	1,280	–	–	–		1,280
	Mercury	5	0%	0	0	–	–	–		0
	Nickel	5	0%	5	20	–	–	–		20
	Nitrate	NA	NA	NA	NA	–	–	–	[1]	–
	Nitrite	NA	NA	NA	NA	–	–	–	[1]	–
	Selenium	6	0%	2	3	–	–	–		3
	Silver	5	0%	1	5	–	–	–		5
	Thallium	5	0%	5	13	–	–	–		13
	Vanadium	5	0%	6	25	–	–	–		25
	Zinc	8	50%	48	111	–	–	–		111
CDM01b	Aluminum	8	25%	61	166	–	–	–		166
	Antimony	8	0%	6	30	–	–	–		30
	Arsenic	8	13%	3	8	–	–	–		8
	Beryllium	8	0%	1	3	–	–	–		3
	Cadmium	8	0%	0	1	–	–	–		1
	Chromium	8	25%	2	5	–	–	–		5
	Cobalt	NA	NA	NA	NA	–	–	–	[1]	–
	Copper	8	75%	23	35	–	–	–		35
	Iron	8	75%	2,836	7,830	–	–	–		7,830
	Lead	8	13%	1	3	–	–	–	[2]	1
	Manganese	8	100%	576	1,090	–	–	–		1,090
	Mercury	8	0%	0	0	–	–	–		0
	Nickel	8	100%	29	59	–	–	–		59
	Nitrate	NA	NA	NA	NA	–	–	–	[1]	–
	Nitrite	NA	NA	NA	NA	–	–	–	[1]	–
	Selenium	8	13%	2	6	–	–	–		6
	Silver	8	0%	1	1	–	–	–		1
	Thallium	8	0%	4	13	–	–	–		13
	Vanadium	8	13%	1	2	–	–	–		2
	Zinc	8	100%	72	163	–	–	–		163

Table D-5. On-Site Groundwater Exposure Point Concentrations (Dissolved Fraction)

EXPOSURE UNIT	CHEMICAL	NUMBER OF SAMPLES	DETECTION FREQUENCY	CONCENTRATION (ug/L)			DATA DISTRIBUTION	95th UCL METHOD		EXPOSURE POINT CONCENTRATION (ug/L)
				MEAN	MAX	95th UCL				
CDM02	Aluminum	9	89%	2,057	6,910	--	--	--		6,910
	Antimony	9	11%	7	30	--	--	--		30
	Arsenic	9	11%	3	8	--	--	--		8
	Beryllium	9	33%	1	4	--	--	--		4
	Cadmium	9	44%	5	18	--	--	--		18
	Chromium	9	11%	2	5	--	--	--		5
	Cobalt	NA	NA	NA	NA	--	--	--	[1]	--
	Copper	9	100%	250	331	--	--	--		331
	Iron	9	100%	102,922	258,000	--	--	--		258,000
	Lead	9	22%	4	20	--	--	--	[2]	4
	Manganese	9	100%	9,027	12,500	--	--	--		12,500
	Mercury	9	11%	0	0	--	--	--		0
	Nickel	9	100%	213	287	--	--	--		287
	Nitrate	NA	NA	NA	NA	--	--	--	[1]	--
	Nitrite	NA	NA	NA	NA	--	--	--	[1]	--
	Selenium	9	11%	4	18	--	--	--		18
	Silver	9	11%	2	5	--	--	--		5
	Thallium	9	33%	6	14	--	--	--		14
	Vanadium	9	11%	4	25	--	--	--		25
	Zinc	9	100%	1,323	2,710	--	--	--		2,710
CDM03b	Aluminum	9	100%	415,111	889,000	--	--	--		889,000
	Antimony	9	0%	5	30	--	--	--		30
	Arsenic	9	100%	200	522	--	--	--		522
	Beryllium	9	100%	30	59	--	--	--		59
	Cadmium	9	100%	688	1,090	--	--	--		1,090
	Chromium	9	100%	317	1,010	--	--	--		1,010
	Cobalt	NA	NA	NA	NA	--	--	--	[1]	--
	Copper	9	100%	139,956	334,000	--	--	--		334,000
	Iron	9	100%	542,167	1,420,000	--	--	--		1,420,000
	Lead	9	100%	167	349	--	--	--	[2]	167
	Manganese	9	100%	18,801	30,300	--	--	--		30,300
	Mercury	9	11%	0	0	--	--	--		0
	Nickel	9	100%	1,110	2,030	--	--	--		2,030
	Nitrate	NA	NA	NA	NA	--	--	--	[1]	--
	Nitrite	NA	NA	NA	NA	--	--	--	[1]	--
	Selenium	9	11%	9	47	--	--	--		47
	Silver	9	11%	4	29	--	--	--		29
	Thallium	9	22%	9	35	--	--	--		35
	Vanadium	9	89%	237	859	--	--	--		859
	Zinc	9	100%	16,539	28,900	--	--	--		28,900

Table D-5. On-Site Groundwater Exposure Point Concentrations
(Dissolved Fraction)

EXPOSURE UNIT	CHEMICAL	NUMBER OF SAMPLES	DETECTION FREQUENCY	CONCENTRATION (ug/L)			DATA DISTRIBUTION	95th UCL METHOD		EXPOSURE POINT CONCENTRATION (ug/L)
				MEAN	MAX	95th UCL				
CDM04b	Aluminum	5	100%	2,646	9,100	–	–	–		9,100
	Antimony	5	0%	2	2	–	–	–		2
	Arsenic	5	60%	20	78	–	–	–		78
	Beryllium	5	20%	0	1	–	–	–		1
	Cadmium	5	100%	6	12	–	–	–		12
	Chromium	5	60%	3	9	–	–	–		9
	Cobalt	NA	NA	NA	NA	–	–	–	[1]	–
	Copper	5	80%	51	75	–	–	–		75
	Iron	5	100%	4,345	16,700	–	–	–		16,700
	Lead	5	100%	135	412	–	–	–	[2]	135
	Manganese	5	100%	88	262	–	–	–		262
	Mercury	5	0%	0	0	–	–	–		0
	Nickel	5	80%	5	12	–	–	–		12
	Nitrate	NA	NA	NA	NA	–	–	–	[1]	–
	Nitrite	NA	NA	NA	NA	–	–	–	[1]	–
	Selenium	5	0%	2	2	–	–	–		2
	Silver	5	20%	1	3	–	–	–		3
	Thallium	5	0%	2	3	–	–	–		3
	Vanadium	5	60%	8	27	–	–	–		27
	Zinc	5	100%	197	381	–	–	–		381
GE-MW-06	Aluminum	7	100%	18,467	33,800	–	–	–		33,800
	Antimony	3	0%	21	30	–	–	–		30
	Arsenic	3	100%	24	45	–	–	–		45
	Beryllium	3	67%	1	2	–	–	–		2
	Cadmium	7	100%	21	33	–	–	–		33
	Chromium	3	100%	486	706	–	–	–		706
	Cobalt	3	67%	41	66	–	–	–		66
	Copper	7	100%	712	1,530	–	–	–		1,530
	Iron	7	100%	27,943	54,000	–	–	–		54,000
	Lead	7	100%	85	130	–	–	–	[2]	85
	Manganese	3	100%	516	945	–	–	–		945
	Mercury	3	33%	0	0	–	–	–		0
	Nickel	3	100%	924	1,400	–	–	–		1,400
	Nitrate	NA	NA	NA	NA	–	–	–	[1]	–
	Nitrite	NA	NA	NA	NA	–	–	–	[1]	–
	Selenium	4	0%	10	18	–	–	–		18
	Silver	3	33%	4	5	–	–	–		5
	Thallium	3	0%	9	13	–	–	–		13
	Vanadium	3	67%	4	6	–	–	–		6
	Zinc	7	100%	2,084	8,820	–	–	–		8,820

Table D-5. On-Site Groundwater Exposure Point Concentrations (Dissolved Fraction)

EXPOSURE UNIT	CHEMICAL	NUMBER OF SAMPLES	DETECTION FREQUENCY	CONCENTRATION (ug/L)			DATA DISTRIBUTION	95th UCL METHOD		EXPOSURE POINT CONCENTRATION (ug/L)
				MEAN	MAX	95th UCL				
GE-MW-07	Aluminum	9	100%	27,000	40,900	--	--	--		40,900
	Antimony	9	0%	8	30	--	--	--		30
	Arsenic	9	67%	6	9	--	--	--		9
	Beryllium	9	89%	4	5	--	--	--		5
	Cadmium	9	100%	61	95	--	--	--		95
	Chromium	9	67%	2	5	--	--	--		5
	Cobalt	NA	NA	NA	NA	--	--	--	[1]	--
	Copper	9	100%	493	853	--	--	--		853
	Iron	9	100%	1,542	3,840	--	--	--		3,840
	Lead	9	89%	16	27	--	--	--	[2]	16
	Manganese	9	100%	3,048	3,850	--	--	--		3,850
	Mercury	9	0%	0	0	--	--	--		0
	Nickel	9	100%	164	202	--	--	--		202
	Nitrate	1	100%	280	280	--	--	--		280
	Nitrite	1	100%	650	650	--	--	--		650
	Selenium	9	11%	4	18	--	--	--		18
	Silver	9	0%	2	5	--	--	--		5
	Thallium	9	11%	4	13	--	--	--		13
	Vanadium	9	0%	6	25	--	--	--		25
	Zinc	9	100%	3,800	4,790	--	--	--		4,790
GE-MW-08	Aluminum	12	100%	66,418	455,000	132,026	lognormal	95% Chebyshev (MVUE) UCL		132,026
	Antimony	8	0%	6	30	--	--	--		30
	Arsenic	8	100%	81	166	--	--	--		166
	Beryllium	8	100%	33	58	--	--	--		58
	Cadmium	12	100%	121	385	177	gamma	Approximate Gamma UCL		177
	Chromium	8	0%	1	5	--	--	--		5
	Cobalt	8	100%	323	492	--	--	--		492
	Copper	12	50%	1,285	15,200	13,872	non-parameteric	99% Chebyshev (Mean, Sd) UCL		13,872
	Iron	12	100%	254,333	446,000	332,482	gamma	Approximate Gamma UCL		332,482
	Lead	12	100%	643	1,540	NA	NA	NA	[2]	643
	Manganese	8	100%	59,788	92,200	--	--	--		92,200
	Mercury	8	25%	0	2	--	--	--		2
	Nickel	8	100%	69	111	--	--	--		111
	Nitrate	NA	NA	NA	NA	--	--	--	[1]	--
	Nitrite	NA	NA	NA	NA	--	--	--	[1]	--
	Selenium	9	33%	8	45	--	--	--		45
	Silver	8	13%	2	5	--	--	--		5
	Thallium	8	50%	16	51	--	--	--		51
	Vanadium	8	38%	5	35	--	--	--		35
	Zinc	12	100%	13,796	35,800	18,939	gamma	Approximate Gamma UCL		18,939

Table D-5. On-Site Groundwater Exposure Point Concentrations
(Dissolved Fraction)

EXPOSURE UNIT	CHEMICAL	NUMBER OF SAMPLES	DETECTION FREQUENCY	CONCENTRATION (ug/L)			DATA DISTRIBUTION	95th UCL METHOD		EXPOSURE POINT CONCENTRATION (ug/L)
				MEAN	MAX	95th UCL				
GE-MW-15	Aluminum	3	100%	95,500	130,000	--	--	--		130,000
	Antimony	NA	NA	NA	NA	--	--	--	[1]	--
	Arsenic	1	100%	6	6	--	--	--		6
	Beryllium	NA	NA	NA	NA	--	--	--	[1]	--
	Cadmium	3	100%	495	618	--	--	--		618
	Chromium	1	100%	24	24	--	--	--		24
	Cobalt	NA	NA	NA	NA	--	--	--	[1]	--
	Copper	4	100%	1,533	2,850	--	--	--		2,850
	Iron	3	100%	262,667	277,000	--	--	--		277,000
	Lead	3	100%	35	55	--	--	--	[2]	35
	Manganese	1	100%	13,300	13,300	--	--	--		13,300
	Mercury	NA	NA	NA	NA	--	--	--	[1]	--
	Nickel	1	100%	406	406	--	--	--		406
	Nitrate	1	0%	25	25	--	--	--		25
	Nitrite	NA	NA	NA	NA	--	--	--	[1]	--
	Selenium	1	100%	8	8	--	--	--		8
	Silver	NA	NA	NA	NA	--	--	--	[1]	--
	Thallium	NA	NA	NA	NA	--	--	--	[1]	--
	Vanadium	NA	NA	NA	NA	--	--	--	[1]	--
	Zinc	3	100%	12,800	14,100	--	--	--		14,100
GE-MW-16	Aluminum	3	100%	176,333	222,000	--	--	--		222,000
	Antimony	NA	NA	NA	NA	--	--	--	[1]	--
	Arsenic	1	100%	24	24	--	--	--		24
	Beryllium	NA	NA	NA	NA	--	--	--	[1]	--
	Cadmium	3	100%	501	635	--	--	--		635
	Chromium	NA	NA	NA	NA	--	--	--	[1]	--
	Cobalt	NA	NA	NA	NA	--	--	--	[1]	--
	Copper	3	100%	9,173	10,400	--	--	--		10,400
	Iron	3	100%	18,830	40,900	--	--	--		40,900
	Lead	3	100%	13	21	--	--	--	[2]	13
	Manganese	1	100%	24,100	24,100	--	--	--		24,100
	Mercury	NA	NA	NA	NA	--	--	--	[1]	--
	Nickel	NA	NA	NA	NA	--	--	--	[1]	--
	Nitrate	1	100%	2,350	2,350	--	--	--		2,350
	Nitrite	NA	NA	NA	NA	--	--	--	[1]	--
	Selenium	1	100%	44	44	--	--	--		44
	Silver	NA	NA	NA	NA	--	--	--	[1]	--
	Thallium	NA	NA	NA	NA	--	--	--	[1]	--
	Vanadium	NA	NA	NA	NA	--	--	--	[1]	--
	Zinc	3	100%	12,967	16,500	--	--	--		16,500

Table D-5. On-Site Groundwater Exposure Point Concentrations
(Dissolved Fraction)

EXPOSURE UNIT	CHEMICAL	NUMBER OF SAMPLES	DETECTION FREQUENCY	CONCENTRATION (ug/L) MEAN	CONCENTRATION (ug/L) MAX	CONCENTRATION (ug/L) 95th UCL	DATA DISTRIBUTION	95th UCL METHOD		EXPOSURE POINT CONCENTRATION (ug/L)
GE-MW-17	Aluminum	3	100%	74,333	76,600	--	--	--		76,600
	Antimony	NA	NA	NA	NA	--	--	--	[1]	--
	Arsenic	1	0%	3	3	--	--	--		3
	Beryllium	NA	NA	NA	NA	--	--	--	[1]	--
	Cadmium	3	100%	329	386	--	--	--		386
	Chromium	NA	NA	NA	NA	--	--	--	[1]	--
	Cobalt	NA	NA	NA	NA	--	--	--	[1]	--
	Copper	3	100%	11,097	14,000	--	--	--		14,000
	Iron	3	100%	48,700	53,900	--	--	--		53,900
	Lead	3	100%	36	42	--	--	--	[2]	36
	Manganese	1	100%	8,730	8,730	--	--	--		8,730
	Mercury	NA	NA	NA	NA	--	--	--	[1]	--
	Nickel	NA	NA	NA	NA	--	--	--	[1]	--
	Nitrate	1	100%	91	91	--	--	--		91
	Nitrite	NA	NA	NA	NA	--	--	--	[1]	--
	Selenium	1	100%	10	10	--	--	--		10
	Silver	NA	NA	NA	NA	--	--	--	[1]	--
	Thallium	NA	NA	NA	NA	--	--	--	[1]	--
	Vanadium	NA	NA	NA	NA	--	--	--	[1]	--
	Zinc	3	100%	14,433	16,300	--	--	--		16,300
GW-10A	Aluminum	1	100%	101	101	--	--	--		101
	Antimony	1	0%	2	2	--	--	--		2
	Arsenic	1	100%	7	7	--	--	--		7
	Beryllium	1	0%	0	0	--	--	--		0
	Cadmium	1	100%	2	2	--	--	--		2
	Chromium	1	0%	1	1	--	--	--		1
	Cobalt	NA	NA	NA	NA	--	--	--	[1]	--
	Copper	1	100%	269	269	--	--	--		269
	Iron	1	0%	14	14	--	--	--		14
	Lead	1	0%	1	1	--	--	--	[2]	1
	Manganese	1	100%	23	23	--	--	--		23
	Mercury	1	0%	0	0	--	--	--		0
	Nickel	1	100%	25	25	--	--	--		25
	Nitrate	NA	NA	NA	NA	--	--	--	[1]	--
	Nitrite	NA	NA	NA	NA	--	--	--	[1]	--
	Selenium	1	0%	2	2	--	--	--		2
	Silver	1	0%	1	1	--	--	--		1
	Thallium	1	0%	4	4	--	--	--		4
	Vanadium	1	0%	1	1	--	--	--		1
	Zinc	1	100%	138	138	--	--	--		138

Table D-5. On-Site Groundwater Exposure Point Concentrations (Dissolved Fraction)

EXPOSURE UNIT	CHEMICAL	NUMBER OF SAMPLES	DETECTION FREQUENCY	CONCENTRATION (ug/L)			DATA DISTRIBUTION	95th UCL METHOD		EXPOSURE POINT CONCENTRATION (ug/L)
				MEAN	MAX	95th UCL				
GW-8	Aluminum	11	100%	54,682	95,900	66,465	normal	Student's t-UCL		66,465
	Antimony	8	13%	13	58	--	--	--		58
	Arsenic	8	75%	12	16	--	--	--		16
	Beryllium	8	100%	27	34	--	--	--		34
	Cadmium	11	100%	136	192	155	normal	Student's t-UCL		155
	Chromium	8	100%	15	27	--	--	--		27
	Cobalt	8	100%	202	276	--	--	--		276
	Copper	11	100%	4,695	8,300	5,631	normal	Student's t-UCL		5,631
	Iron	11	64%	251	772	552	gamma	Approximate Gamma UCL		552
	Lead	11	73%	10	35	NA	NA	NA	[2]	10
	Manganese	8	100%	12,816	15,800	--	--	--		15,800
	Mercury	8	0%	0	0	--	--	--		0
	Nickel	8	100%	359	445	--	--	--		445
	Nitrate	NA	NA	NA	NA	--	--	--	[1]	--
	Nitrite	NA	NA	NA	NA	--	--	--	[1]	--
	Selenium	9	33%	4	9	--	--	--		9
	Silver	8	0%	1	5	--	--	--		5
	Thallium	8	25%	4	11	--	--	--		11
	Vanadium	8	0%	4	25	--	--	--		25
	Zinc	11	100%	4,329	6,010	4,934	normal	Student's t-UCL		4,934
GWCDM11	Aluminum	4	50%	175	414	--	--	--		414
	Antimony	4	0%	9	30	--	--	--		30
	Arsenic	4	0%	4	8	--	--	--		8
	Beryllium	4	0%	1	3	--	--	--		3
	Cadmium	4	25%	1	3	--	--	--		3
	Chromium	4	0%	2	5	--	--	--		5
	Cobalt	NA	NA	NA	NA	--	--	--	[1]	--
	Copper	4	100%	72	92	--	--	--		92
	Iron	4	50%	386	1,450	--	--	--		1,450
	Lead	4	25%	3	5	--	--	--	[2]	3
	Manganese	4	100%	78	114	--	--	--		114
	Mercury	4	25%	0	1	--	--	--		1
	Nickel	4	75%	4	7	--	--	--		7
	Nitrate	NA	NA	NA	NA	--	--	--	[1]	--
	Nitrite	NA	NA	NA	NA	--	--	--	[1]	--
	Selenium	4	50%	6	9	--	--	--		9
	Silver	4	0%	2	5	--	--	--		5
	Thallium	4	0%	5	13	--	--	--		13
	Vanadium	4	0%	7	25	--	--	--		25
	Zinc	4	100%	87	129	--	--	--		129

Table D-5. On-Site Groundwater Exposure Point Concentrations (Dissolved Fraction)

EXPOSURE UNIT	CHEMICAL	NUMBER OF SAMPLES	DETECTION FREQUENCY	CONCENTRATION (ug/L)			DATA DISTRIBUTION	95th UCL METHOD		EXPOSURE POINT CONCENTRATION (ug/L)
				MEAN	MAX	95th UCL				
GWCDM12	Aluminum	5	40%	204	613	--	--	--		613
	Antimony	5	0%	13	30	--	--	--		30
	Arsenic	5	0%	4	8	--	--	--		8
	Beryllium	5	0%	1	3	--	--	--		3
	Cadmium	5	80%	3	5	--	--	--		5
	Chromium	5	20%	2	5	--	--	--		5
	Cobalt	NA	NA	NA	NA	--	--	--	[1]	--
	Copper	5	100%	134	358	--	--	--		358
	Iron	5	60%	1,313	4,810	--	--	--		4,810
	Lead	5	20%	3	5	--	--	--	[2]	3
	Manganese	5	100%	4,302	10,500	--	--	--		10,500
	Mercury	5	0%	0	0	--	--	--		0
	Nickel	5	100%	59	152	--	--	--		152
	Nitrate	1	100%	7,900	7,900	--	--	--		7,900
	Nitrite	1	100%	200	200	--	--	--		200
	Selenium	5	0%	5	18	--	--	--		18
	Silver	5	0%	2	5	--	--	--		5
	Thallium	5	0%	6	13	--	--	--		13
	Vanadium	5	0%	10	25	--	--	--		25
	Zinc	5	100%	445	1,060	--	--	--		1,060

NA = Not Applicable.
-- Due to sample size (less than 10), a 95th UCL was not calculated.

[1] Chemical not analyzed; no EPC for this chemical.
[2] Risks to lead are evaluated based on the mean concentration; a 95th UCL was not calculated.

Table D-6. On-Site Groundwater Exposure Point Concentrations
(Total Fraction)

EXPOSURE UNIT	CHEMICAL	NUMBER OF SAMPLES	DETECTION FREQUENCY	CONCENTRATION (ug/L)			DATA DISTRIBUTION	95th UCL METHOD		EXPOSURE POINT CONCENTRATION (ug/L)
				MEAN	MAX	95th UCL				
BED-8	Aluminum	8	50%	55	121	--	--	--		121
	Antimony	5	20%	10	30	--	--	--		30
	Arsenic	5	0%	3	8	--	--	--		8
	Beryllium	5	0%	1	3	--	--	--		3
	Cadmium	8	0%	1	3	--	--	--		3
	Chromium	5	0%	2	5	--	--	--		5
	Cobalt	5	0%	6	25	--	--	--		25
	Copper	8	0%	3	13	--	--	--		13
	Iron	9	67%	93	290	--	--	--		290
	Lead	8	13%	2	5	--	--	--	[2]	2
	Manganese	5	100%	1,168	1,430	--	--	--		1,430
	Mercury	5	0%	0	0	--	--	--		0
	Nickel	5	0%	5	20	--	--	--		20
	Nitrate	1	0%	25	25	--	--	--		25
	Nitrite	NA	NA	NA	NA	--	--	--	[1]	--
	Selenium	6	17%	2	5	--	--	--		5
	Silver	5	0%	1	5	--	--	--		5
	Thallium	5	0%	4	13	--	--	--		13
	Vanadium	5	0%	5	25	--	--	--		25
	Zinc	8	38%	14	25	--	--	--		25
CDM01b	Aluminum	8	50%	1,304	4,690	--	--	--		4,690
	Antimony	8	13%	6	30	--	--	--		30
	Arsenic	8	63%	6	13	--	--	--		13
	Beryllium	8	13%	1	3	--	--	--		3
	Cadmium	8	38%	1	5	--	--	--		5
	Chromium	8	50%	3	10	--	--	--		10
	Cobalt	NA	NA	NA	NA	--	--	--	[1]	--
	Copper	8	100%	52	151	--	--	--		151
	Iron	9	100%	10,458	22,700	--	--	--		22,700
	Lead	8	38%	6	29	--	--	--	[2]	6
	Manganese	8	100%	623	1,040	--	--	--		1,040
	Mercury	8	0%	0	0	--	--	--		0
	Nickel	8	100%	32	53	--	--	--		53
	Nitrate	1	100%	4,290	4,290	--	--	--		4,290
	Nitrite	1	0%	25	25	--	--	--		25
	Selenium	8	25%	2	4	--	--	--		4
	Silver	8	0%	1	5	--	--	--		5
	Thallium	8	0%	4	13	--	--	--		13
	Vanadium	8	38%	6	25	--	--	--		25
	Zinc	8	100%	40	73	--	--	--		73

Table D-6. On-Site Groundwater Exposure Point Concentrations
(Total Fraction)

EXPOSURE UNIT	CHEMICAL	NUMBER OF SAMPLES	DETECTION FREQUENCY	CONCENTRATION (ug/L)			DATA DISTRIBUTION	95th UCL METHOD		EXPOSURE POINT CONCENTRATION (ug/L)
				MEAN	MAX	95th UCL				
CDM02	Aluminum	9	100%	3,038	5,610	--	--	--		5,610
	Antimony	9	22%	8	30	--	--	--		30
	Arsenic	9	56%	5	9	--	--	--		9
	Beryllium	9	44%	1	3	--	--	--		3
	Cadmium	9	67%	9	16	--	--	--		16
	Chromium	9	33%	3	10	--	--	--		10
	Cobalt	NA	NA	NA	NA	--	--	--	[1]	--
	Copper	9	100%	251	341	--	--	--		341
	Iron	10	100%	121,160	350,000	183,347	normal	Student's t-UCL		183,347
	Lead	9	56%	10	39	NA	NA	NA	[2]	10
	Manganese	9	100%	8,443	11,800	--	--	--		11,800
	Mercury	9	11%	0	0	--	--	--		0
	Nickel	9	100%	210	282	--	--	--		282
	Nitrate	1	100%	12,800	12,800	--	--	--		12,800
	Nitrite	1	0%	25	25	--	--	--		25
	Selenium	9	11%	4	18	--	--	--		18
	Silver	9	11%	2	5	--	--	--		5
	Thallium	9	33%	6	16	--	--	--		16
	Vanadium	9	33%	5	25	--	--	--		25
	Zinc	9	100%	1,551	2,830	--	--	--		2,830
CDM03b	Aluminum	9	100%	456,889	932,000	--	--	--		932,000
	Antimony	9	11%	9	36	--	--	--		36
	Arsenic	9	100%	266	798	--	--	--		798
	Beryllium	9	100%	30	58	--	--	--		58
	Cadmium	9	100%	708	1,050	--	--	--		1,050
	Chromium	9	100%	316	975	--	--	--		975
	Cobalt	NA	NA	NA	NA	--	--	--	[1]	--
	Copper	9	100%	131,156	278,000	--	--	--		278,000
	Iron	9	100%	642,900	1,730,000	--	--	--		1,730,000
	Lead	9	100%	206	392	--	--	--	[2]	206
	Manganese	9	100%	19,679	29,700	--	--	--		29,700
	Mercury	9	11%	0	0	--	--	--		0
	Nickel	9	100%	1,139	2,000	--	--	--		2,000
	Nitrate	1	0%	250	250	--	--	--		250
	Nitrite	1	0%	250	250	--	--	--		250
	Selenium	9	22%	9	27	--	--	--		27
	Silver	9	11%	1	5	--	--	--		5
	Thallium	9	44%	14	60	--	--	--		60
	Vanadium	9	100%	243	790	--	--	--		790
	Zinc	9	100%	16,773	27,800	--	--	--		27,800

Table D-6. On-Site Groundwater Exposure Point Concentrations
(Total Fraction)

EXPOSURE UNIT	CHEMICAL	NUMBER OF SAMPLES	DETECTION FREQUENCY	CONCENTRATION (ug/L)			DATA DISTRIBUTION	95th UCL METHOD		EXPOSURE POINT CONCENTRATION (ug/L)
				MEAN	MAX	95th UCL				
CDM04b	Aluminum	5	100%	13,772	41,500	–	–	–		41,500
	Antimony	5	0%	2	2	–	–	–		2
	Arsenic	5	100%	115	419	–	–	–		419
	Beryllium	5	20%	1	4	–	–	–		4
	Cadmium	5	100%	8	12	–	–	–		12
	Chromium	5	100%	16	55	–	–	–		55
	Cobalt	NA	NA	NA	NA	–	–	–	[1]	–
	Copper	5	100%	181	384	–	–	–		384
	Iron	6	100%	20,363	91,300	–	–	–		91,300
	Lead	5	100%	765	2,400	–	–	–	[2]	765
	Manganese	5	100%	209	717	–	–	–		717
	Mercury	5	80%	0	1	–	–	–		1
	Nickel	5	100%	18	52	–	–	–		52
	Nitrate	1	100%	504	504	–	–	–		504
	Nitrite	1	0%	25	25	–	–	–		25
	Selenium	5	20%	3	7	–	–	–		7
	Silver	5	100%	4	14	–	–	–		14
	Thallium	5	0%	2	3	–	–	–		3
	Vanadium	5	100%	47	143	–	–	–		143
	Zinc	5	100%	564	1,370	–	–	–		1,370
GE-MW-06	Aluminum	7	100%	19,340	34,300	–	–	–		34,300
	Antimony	3	0%	21	30	–	–	–		30
	Arsenic	3	100%	30	51	–	–	–		51
	Beryllium	3	67%	1	2	–	–	–		2
	Cadmium	7	100%	23	34	–	–	–		34
	Chromium	3	100%	445	713	–	–	–		713
	Cobalt	3	100%	40	66	–	–	–		66
	Copper	7	100%	832	1,530	–	–	–		1,530
	Iron	8	100%	26,375	56,700	–	–	–		56,700
	Lead	7	100%	97	138	–	–	–	[2]	97
	Manganese	3	100%	522	942	–	–	–		942
	Mercury	3	0%	0	0	–	–	–		0
	Nickel	3	100%	840	1,140	–	–	–		1,140
	Nitrate	1	100%	1,420	1,420	–	–	–		1,420
	Nitrite	NA	NA	NA	NA	–	–	–	[1]	–
	Selenium	4	0%	10	18	–	–	–		18
	Silver	3	0%	4	5	–	–	–		5
	Thallium	3	0%	9	13	–	–	–		13
	Vanadium	3	100%	4	7	–	–	–		7
	Zinc	7	100%	2,048	8,930	–	–	–		8,930

Table D-6. On-Site Groundwater Exposure Point Concentrations
(Total Fraction)

EXPOSURE UNIT	CHEMICAL	NUMBER OF SAMPLES	DETECTION FREQUENCY	CONCENTRATION (ug/L)			DATA DISTRIBUTION	95th UCL METHOD		EXPOSURE POINT CONCENTRATION (ug/L)
				MEAN	MAX	95th UCL				
GE-MW-07	Aluminum	9	100%	27,156	42,300	--	--	--		42,300
	Antimony	9	0%	8	30	--	--	--		30
	Arsenic	9	67%	5	8	--	--	--		8
	Beryllium	9	89%	4	5	--	--	--		5
	Cadmium	9	100%	63	105	--	--	--		105
	Chromium	9	56%	3	5	--	--	--		5
	Cobalt	NA	NA	NA	NA	--	--	--	[1]	--
	Copper	9	100%	501	945	--	--	--		945
	Iron	10	100%	1,681	3,920	2,357	normal	Student's t-UCL		2,357
	Lead	9	89%	19	38	NA	NA	NA	[2]	19
	Manganese	9	100%	3,056	3,810	--	--	--		3,810
	Mercury	9	0%	0	0	--	--	--		0
	Nickel	9	100%	165	205	--	--	--		205
	Nitrate	2	100%	177	280	--	--	--		280
	Nitrite	2	50%	338	650	--	--	--		650
	Selenium	9	22%	5	18	--	--	--		18
	Silver	9	11%	2	5	--	--	--		5
	Thallium	9	11%	4	13	--	--	--		13
	Vanadium	9	0%	6	25	--	--	--		25
	Zinc	9	100%	3,867	4,830	--	--	--		4,830
GE-MW-08	Aluminum	12	100%	71,515	499,000	141,175	lognormal	95% Chebyshev (MVUE) UCL		141,175
	Antimony	8	0%	6	30	--	--	--		30
	Arsenic	8	100%	84	180	--	--	--		180
	Beryllium	8	100%	33	59	--	--	--		59
	Cadmium	12	100%	123	401	--	--	--		401
	Chromium	8	0%	1	5	--	--	--		5
	Cobalt	8	100%	333	530	--	--	--		530
	Copper	12	50%	1,415	16,700	15,241	lognormal	99% Chebyshev (Mean, Sd) UCL		15,241
	Iron	13	100%	270,077	459,000	344,953	gamma	Approximate Gamma UCL		344,953
	Lead	12	100%	688	1,660	NA	NA	NA	[2]	688
	Manganese	8	100%	60,513	93,900	--	--	--		93,900
	Mercury	8	25%	0	3	--	--	--		3
	Nickel	8	100%	70	118	--	--	--		118
	Nitrate	2	0%	138	250	--	--	--		250
	Nitrite	1	0%	250	250	--	--	--		250
	Selenium	9	22%	9	46	--	--	--		46
	Silver	8	38%	2	5	--	--	--		5
	Thallium	8	38%	13	45	--	--	--		45
	Vanadium	8	38%	5	32	--	--	--		32
	Zinc	12	100%	14,434	36,800	19,820	gamma	Approximate Gamma UCL		19,820

Table D-6. On-Site Groundwater Exposure Point Concentrations
(Total Fraction)

EXPOSURE UNIT	CHEMICAL	NUMBER OF SAMPLES	DETECTION FREQUENCY	CONCENTRATION (ug/L)			DATA DISTRIBUTION	95th UCL METHOD		EXPOSURE POINT CONCENTRATION (ug/L)
				MEAN	MAX	95th UCL				
GE-MW-15	Aluminum	2	100%	89,200	109,000	–	–	–		109,000
	Antimony	NA	NA	NA	NA	–	–	–	[1]	–
	Arsenic	NA	NA	NA	NA	–	–	–	[1]	–
	Beryllium	NA	NA	NA	NA	–	–	–	[1]	–
	Cadmium	2	100%	465	552	–	–	–		552
	Chromium	NA	NA	NA	NA	–	–	–	[1]	–
	Cobalt	NA	NA	NA	NA	–	–	–	[1]	–
	Copper	2	100%	1,550	1,970	–	–	–		1,970
	Iron	2	100%	303,500	313,000	–	–	–		313,000
	Lead	2	100%	33	38	–	–	–	[2]	33
	Manganese	NA	NA	NA	NA	–	–	–	[1]	–
	Mercury	NA	NA	NA	NA	–	–	–	[1]	–
	Nickel	NA	NA	NA	NA	–	–	–	[1]	–
	Nitrate	3	33%	73	168	–	–	–		168
	Nitrite	NA	NA	NA	NA	–	–	–	[1]	–
	Selenium	NA	NA	NA	NA	–	–	–	[1]	–
	Silver	NA	NA	NA	NA	–	–	–	[1]	–
	Thallium	NA	NA	NA	NA	–	–	–	[1]	–
	Vanadium	NA	NA	NA	NA	–	–	–	[1]	–
	Zinc	2	100%	12,850	13,600	–	–	–		13,600
GE-MW-16	Aluminum	3	100%	194,000	240,000	–	–	–		240,000
	Antimony	NA	NA	NA	NA	–	–	–	[1]	–
	Arsenic	1	100%	34	34	–	–	–		34
	Beryllium	NA	NA	NA	NA	–	–	–	[1]	–
	Cadmium	3	100%	518	661	–	–	–		661
	Chromium	NA	NA	NA	NA	–	–	–	[1]	–
	Cobalt	NA	NA	NA	NA	–	–	–	[1]	–
	Copper	3	100%	9,803	11,000	–	–	–		11,000
	Iron	3	100%	36,467	52,800	–	–	–		52,800
	Lead	3	100%	29	49	–	–	–	[2]	29
	Manganese	1	100%	25,700	25,700	–	–	–		25,700
	Mercury	NA	NA	NA	NA	–	–	–	[1]	–
	Nickel	NA	NA	NA	NA	–	–	–	[1]	–
	Nitrate	3	100%	1,963	2,750	–	–	–		2,750
	Nitrite	1	0%	25	25	–	–	–		25
	Selenium	1	100%	52	52	–	–	–		52
	Silver	NA	NA	NA	NA	–	–	–	[1]	–
	Thallium	NA	NA	NA	NA	–	–	–	[1]	–
	Vanadium	NA	NA	NA	NA	–	–	–	[1]	–
	Zinc	3	100%	13,833	17,600	–	–	–		17,600

Table D-6. On-Site Groundwater Exposure Point Concentrations
(Total Fraction)

EXPOSURE UNIT	CHEMICAL	NUMBER OF SAMPLES	DETECTION FREQUENCY	CONCENTRATION (ug/L)			DATA DISTRIBUTION	95th UCL METHOD		EXPOSURE POINT CONCENTRATION (ug/L)
				MEAN	MAX	95th UCL				
GE-MW-17	Aluminum	3	100%	79,267	81,600	--	--	--		81,600
	Antimony	NA	NA	NA	NA	--	--	--	[1]	--
	Arsenic	1	0%	3	3	--	--	--		3
	Beryllium	NA	NA	NA	NA	--	--	--	[1]	--
	Cadmium	3	100%	339	387	--	--	--		387
	Chromium	NA	NA	NA	NA	--	--	--	[1]	--
	Cobalt	NA	NA	NA	NA	--	--	--	[1]	--
	Copper	3	100%	11,397	14,400	--	--	--		14,400
	Iron	3	100%	52,333	57,700	--	--	--		57,700
	Lead	3	100%	38	43	--	--	--	[2]	38
	Manganese	1	100%	9,390	9,390	--	--	--		9,390
	Mercury	NA	NA	NA	NA	--	--	--	[1]	--
	Nickel	NA	NA	NA	NA	--	--	--	[1]	--
	Nitrate	3	100%	3,980	10,200	--	--	--		10,200
	Nitrite	1	0%	25	25	--	--	--		25
	Selenium	1	100%	11	11	--	--	--		11
	Silver	NA	NA	NA	NA	--	--	--	[1]	--
	Thallium	NA	NA	NA	NA	--	--	--	[1]	--
	Vanadium	NA	NA	NA	NA	--	--	--	[1]	--
	Zinc	3	100%	14,767	16,700	--	--	--		16,700
GW-10A	Aluminum	1	100%	1,400	1,400	--	--	--		1,400
	Antimony	1	0%	2	2	--	--	--		2
	Arsenic	1	100%	10	10	--	--	--		10
	Beryllium	1	100%	1	1	--	--	--		1
	Cadmium	1	100%	3	3	--	--	--		3
	Chromium	1	100%	13	13	--	--	--		13
	Cobalt	NA	NA	NA	NA	--	--	--	[1]	--
	Copper	1	100%	415	415	--	--	--		415
	Iron	1	100%	3,170	3,170	--	--	--		3,170
	Lead	1	100%	64	64	--	--	--	[2]	64
	Manganese	1	100%	42	42	--	--	--		42
	Mercury	1	0%	0	0	--	--	--		0
	Nickel	1	100%	38	36	--	--	--		36
	Nitrate	NA	NA	NA	NA	--	--	--	[1]	--
	Nitrite	NA	NA	NA	NA	--	--	--	[1]	--
	Selenium	1	0%	3	3	--	--	--		3
	Silver	1	0%	1	1	--	--	--		1
	Thallium	1	0%	2	2	--	--	--		2
	Vanadium	1	100%	2	2	--	--	--		2
	Zinc	1	100%	74	74	--	--	--		74

Table D-6. On-Site Groundwater Exposure Point Concentrations
(Total Fraction)

EXPOSURE UNIT	CHEMICAL	NUMBER OF SAMPLES	DETECTION FREQUENCY	CONCENTRATION (ug/L)			DATA DISTRIBUTION	95th UCL METHOD		EXPOSURE POINT CONCENTRATION (ug/L)
				MEAN	MAX	95th UCL				
GW-8	Aluminum	11	100%	57,764	114,000	71,417	normal	Student's t-UCL		71,417
	Antimony	8	25%	10	30	--	--	--		30
	Arsenic	8	75%	17	37	--	--	--		37
	Beryllium	8	100%	27	35	--	--	--		35
	Cadmium	11	100%	137	205	156	normal	Student's t-UCL		156
	Chromium	8	100%	17	38	--	--	--		38
	Cobalt	8	100%	199	292	--	--	--		292
	Copper	11	100%	4,745	9,060	5,760	normal	Student's t-UCL		5,760
	Iron	12	83%	2,446	13,900	5,586	gamma	Approximate Gamma UCL		5,586
	Lead	11	91%	14	40	NA	NA	NA	[2]	14
	Manganese	8	100%	12,578	16,700	--	--	--		16,700
	Mercury	8	13%	0	0	--	--	--		0
	Nickel	8	100%	354	471	--	--	--		471
	Nitrate	2	100%	11,840	19,600	--	--	--		19,600
	Nitrite	1	0%	25	25	--	--	--		25
	Selenium	9	22%	4	8	--	--	--		8
	Silver	8	25%	2	7	--	--	--		7
	Thallium	8	25%	4	10	--	--	--		10
	Vanadium	8	13%	4	25	--	--	--		25
	Zinc	11	100%	4,431	6,200	5,061	normal	Student's t-UCL		5,061
GWCDM11	Aluminum	4	100%	5,435	17,000	--	--	--		17,000
	Antimony	4	0%	9	30	--	--	--		30
	Arsenic	4	50%	10	16	--	--	--		16
	Beryllium	4	0%	1	3	--	--	--		3
	Cadmium	4	0%	1	3	--	--	--		3
	Chromium	4	100%	18	54	--	--	--		54
	Cobalt	NA	NA	NA	NA	--	--	--	[1]	--
	Copper	4	100%	89	129	--	--	--		129
	Iron	4	100%	13,810	40,200	--	--	--		40,200
	Lead	4	50%	7	15	--	--	--	[2]	7
	Manganese	4	100%	1,200	4,530	--	--	--		4,530
	Mercury	4	50%	0	1	--	--	--		1
	Nickel	4	100%	23	74	--	--	--		74
	Nitrate	NA	NA	NA	NA	--	--	--	[1]	--
	Nitrite	NA	NA	NA	NA	--	--	--	[1]	--
	Selenium	4	50%	6	9	--	--	--		9
	Silver	4	25%	2	5	--	--	--		5
	Thallium	4	25%	6	13	--	--	--		13
	Vanadium	4	75%	12	40	--	--	--		40
	Zinc	4	100%	78	264	--	--	--		264

Table D-6. On-Site Groundwater Exposure Point Concentrations (Total Fraction)

EXPOSURE UNIT	CHEMICAL	NUMBER OF SAMPLES	DETECTION FREQUENCY	CONCENTRATION (ug/L)			DATA DISTRIBUTION	95th UCL METHOD		EXPOSURE POINT CONCENTRATION (ug/L)
				MEAN	MAX	95th UCL				
GWCDM12	Aluminum	5	100%	6,048	17,100	–	–	–		17,100
	Antimony	5	0%	13	30	–	–	–		30
	Arsenic	5	40%	10	15	–	–	–		15
	Beryllium	5	40%	1	3	–	–	–		3
	Cadmium	5	80%	2	4	–	–	–		4
	Chromium	5	100%	18	53	–	–	–		53
	Cobalt	NA	NA	NA	NA	–	–	–	[1]	–
	Copper	5	100%	92	157	–	–	–		157
	Iron	5	100%	14,974	38,600	–	–	–		38,600
	Lead	5	40%	6	13	–	–	–	[2]	6
	Manganese	5	100%	3,068	4,770	–	–	–		4,770
	Mercury	5	20%	0	1	–	–	–		1
	Nickel	5	100%	48	69	–	–	–		69
	Nitrate	1	100%	7,900	7,900	–	–	–		7,900
	Nitrite	1	100%	200	200	–	–	–		200
	Selenium	5	0%	5	18	–	–	–		18
	Silver	5	40%	3	5	–	–	–		5
	Thallium	5	0%	6	13	–	–	–		13
	Vanadium	5	80%	13	42	–	–	–		42
	Zinc	5	100%	265	477	–	–	–		477

NA = Not Applicable.
-- Due to sample size (less than 10), a 95th UCL was not calculated.

[1] Chemical not analyzed; no EPC for this chemical.
[2] Risks to lead are evaluated based on the mean concentration; a 95th UCL was not calculated.

Table D-7. Off-Site Surface Water Exposure Point Concentrations

EXPOSURE UNIT	CHEMICAL	NUMBER OF SAMPLES	DETECTION FREQUENCY	CONCENTRATION (ug/L)			DATA DISTRIBUTION	95th UCL METHOD		EXPOSURE POINT CONCENTRATION (ug/L)
				MEAN	MAX	95th UCL				
BBC0	Aluminum	8	25%	73.31875	309	--	--	--		309
	Arsenic	8	13%	2	4	--	--	--		4
	Beryllium	8	0%	0	1	--	--	--		0.5
	Cadmium	8	0%	0	1	--	--	--		0.5
	Chromium	8	0%	0	1	--	--	--		0.7
	Cobalt	NA	NA	NA	NA	--	--	--	[1]	NA
	Copper	8	13%	1	3	--	--	--		3
	Cyanide	8	13%	2	4	--	--	--		4
	Iron	8	50%	169	802	--	--	--		802
	Lead	8	13%	3	14	NA	NA	NA	[2]	3
	Lithium	NA	NA	NA	NA	--	--	--	[1]	NA
	Manganese	8	88%	19	61	--	--	--		61
	Nickel	8	25%	1	2	--	--	--		2
	Nitrate	1	100%	123	123	--	--	--		123
	Selenium	8	0%	2	2	--	--	--		2
	Silver	8	0%	0	1	--	--	--		1.0
	Strontium	2	0%	150.	150	--	--	--		150
	Thallium	8	0%	2	4	--	--	--		4
	Vanadium	8	0%	0	1	--	--	--		0.9
	Zinc	8	63%	9	25	--	--	--		25
BBC1	Aluminum	43	53%	213	4,420	1,251	non-parameteric	99% Chebyshev (Mean, Sd) UCL		1,251
	Arsenic	42	5%	2	4	3	non-parameteric	Student's-t UCL	[3]	3
	Beryllium	38	3%	0	1	1	non-parameteric	95% Chebyshev (Mean, Sd) UCL		0.6
	Cadmium	43	14%	1	3	1	non-parameteric	95% Chebyshev (Mean, Sd) UCL		1.0
	Chromium	42	12%	1	8	2	non-parameteric	95% Chebyshev (Mean, Sd) UCL		2
	Cobalt	8	38%	3	9	--	--	--		9
	Copper	43	23%	4	44	9	non-parameteric	95% Chebyshev (Mean, Sd) UCL		9
	Cyanide	41	2%	4	5	5	non-parameteric	95% Chebyshev (Mean, Sd) UCL		5
	Iron	25	72%	147	577	264	lognormal	95% H-UCL		264
	Lead	43	7%	1	23	NA	NA	NA	[2]	1
	Lithium	NA	NA	NA	NA	--	--	--	[1]	NA
	Manganese	38	45%	28	177	53	non-parameteric	95% Chebyshev (Mean, Sd) UCL		53
	Nickel	42	24%	3	15	5	non-parameteric	95% Chebyshev (Mean, Sd) UCL		5
	Nitrate	29	90%	4,954	19,500	17,019	non-parameteric	99% Chebyshev (Mean, Sd) UCL		17,019
	Selenium	43	2%	2	5	3	non-parameteric	Mod-t UCL (Adjusted for skewness)	[3]	3
	Silver	42	0%	0	1	1	non-parameteric	Mod-t UCL (Adjusted for skewness)	[3]	0.5
	Strontium	2	0%	150	150	--	--	--		150
	Thallium	8	0%	3	4	--	--	--		4
	Vanadium	8	0%	0	1	--	--	--		0.9
	Zinc	43	23%	28	126	41	non-parameteric	95% Chebyshev (Mean, Sd) UCL		41

Table D-7. Off-Site Surface Water Exposure Point Concentrations

EXPOSURE UNIT	CHEMICAL	NUMBER OF SAMPLES	DETECTION FREQUENCY	CONCENTRATION (ug/L)			DATA DISTRIBUTION	95th UCL METHOD		EXPOSURE POINT CONCENTRATION (ug/L)
				MEAN	MAX	95th UCL				
BBC2	Aluminum	6	33%	137	538	--	--	--		538
	Arsenic	6	33%	2	4	--	--	--		4
	Beryllium	6	0%	0	1	--	--	--		0.9
	Cadmium	6	17%	0	1	--	--	--		0.6
	Chromium	6	0%	1	1	--	--	--		1.0
	Cobalt	NA	NA	NA	NA	--	--	--	[1]	NA
	Copper	6	67%	4	7	--	--	--		7
	Cyanide	6	33%	3	13	--	--	--		13
	Iron	6	50%	147	691	--	--	--		691
	Lead	6	0%	1	1	NA	NA	NA	[2]	0.9
	Lithium	NA	NA	NA	NA	--	--	--	[1]	NA
	Manganese	6	67%	45	98	--	--	--		98
	Nickel	6	33%	1	3	--	--	--		3
	Nitrate	NA	NA	NA	NA	--	--	--	[1]	NA
	Selenium	6	0%	2	2	--	--	--		2
	Silver	6	0%	0	1	--	--	--		0.6
	Strontium	2	0%	150	150	--	--	--		150
	Thallium	6	0%	3	4	--	--	--		4
	Vanadium	6	0%	1	1	--	--	--		0.9
	Zinc	6	67%	11	30	--	--	--		30
BBC3	Aluminum	6	33%	106	339	--	--	--		339
	Arsenic	6	17%	2	3	--	--	--		3
	Beryllium	6	0%	0	1	--	--	--		0.9
	Cadmium	6	33%	0	1	--	--	--		0.7
	Chromium	6	17%	1	3	--	--	--		3
	Cobalt	NA	NA	NA	NA	--	--	--	[1]	NA
	Copper	6	67%	4	13	--	--	--		13
	Cyanide	6	0%	2	4	--	--	--		4
	Iron	6	50%	128	594	--	--	--		594
	Lead	6	17%	1	2	NA	NA	NA	[2]	1
	Lithium	NA	NA	NA	NA	--	--	--	[1]	NA
	Manganese	6	50%	42	87	--	--	--		87
	Nickel	6	33%	1	2	--	--	--		2
	Nitrate	NA	NA	NA	NA	--	--	--	[1]	NA
	Selenium	6	0%	2	2	--	--	--		2
	Silver	6	17%	1	6	--	--	--		6
	Strontium	2	0%	150	150	--	--	--		150
	Thallium	6	17%	3	5	--	--	--		5
	Vanadium	6	17%	1	5	--	--	--		5
	Zinc	6	67%	7	16	--	--	--		16

Table D-7. Off-Site Surface Water Exposure Point Concentrations

EXPOSURE UNIT	CHEMICAL	NUMBER OF SAMPLES	DETECTION FREQUENCY	CONCENTRATION (ug/L)			DATA DISTRIBUTION	95th UCL METHOD		EXPOSURE POINT CONCENTRATION (ug/L)
				MEAN	MAX	95th UCL				
BBC4	Aluminum	8	25%	108	358	--	--	--		358
	Arsenic	8	0%	2	2	--	--	--		2
	Beryllium	8	13%	0	1	--	--	--		0.8
	Cadmium	8	25%	0	1	--	--	--		0.6
	Chromium	8	0%	0	1	--	--	--		0.7
	Cobalt	NA	NA	NA	NA	--	--	--	[1]	NA
	Copper	8	50%	5	17	--	--	--		17
	Cyanide	8	13%	2	3	--	--	--		3
	Iron	8	63%	139	556	--	--	--		556
	Lead	8	13%	2	10	NA	NA	NA	[2]	2
	Lithium	NA	NA	NA	NA	--	--	--	[1]	NA
	Manganese	8	88%	29	62	--	--	--		62
	Nickel	8	38%	1	4	--	--	--		4
	Nitrate	1	100%	730	730	--	--	--		730
	Selenium	8	0%	2	2	--	--	--		2
	Silver	8	0%	0	1	--	--	--		0.9
	Strontium	2	0%	150	150	--	--	--		150
	Thallium	8	0%	2	4	--	--	--		4
	Vanadium	8	0%	1	1	--	--	--		0.9
	Zinc	8	63%	17	39	--	--	--		39
BHG	Aluminum	6	33%	106	386	--	--	--		386
	Arsenic	6	33%	2	6	--	--	--		6
	Beryllium	6	0%	0	1	--	--	--		0.9
	Cadmium	6	0%	0	0	--	--	--		0.3
	Chromium	6	0%	0	1	--	--	--		0.7
	Cobalt	NA	NA	NA	NA	--	--	--	[1]	NA
	Copper	6	17%	1	2	--	--	--		2
	Cyanide	6	17%	5	25	--	--	--		25
	Iron	6	50%	57	244	--	--	--		244
	Lead	6	17%	1	2	NA	NA	NA	[2]	1
	Lithium	NA	NA	NA	NA	--	--	--	[1]	NA
	Manganese	6	50%	8	22	--	--	--		22
	Nickel	6	17%	1	1	--	--	--		1
	Nitrate	NA	NA	NA	NA	--	--	--	[1]	NA
	Selenium	6	0%	2	2	--	--	--		2
	Silver	6	0%	0	1	--	--	--		0.6
	Strontium	2	0%	150	150	--	--	--		150
	Thallium	6	0%	3	4	--	--	--		4
	Vanadium	6	0%	1	1	--	--	--		0.9
	Zinc	6	17%	4	11	--	--	--		11

Table D-7. Off-Site Surface Water Exposure Point Concentrations

EXPOSURE UNIT	CHEMICAL	NUMBER OF SAMPLES	DETECTION FREQUENCY	CONCENTRATION (ug/L)			DATA DISTRIBUTION	95th UCL METHOD		EXPOSURE POINT CONCENTRATION (ug/L)
				MEAN	MAX	95th UCL				
BKD1	Aluminum	1	100%	461	461	--	--	--		461
	Arsenic	1	0%	3	3	--	--	--		3
	Beryllium	1	0%	0.1	0.1	--	--	--		0.1
	Cadmium	1	0%	0.2	0.2	--	--	--		0.2
	Chromium	1	0%	0.4	0.4	--	--	--		0.4
	Cobalt	NA	NA	NA	NA	--	--	--	[1]	--
	Copper	1	100%	6	6	--	--	--		6
	Cyanide	1	0%	1	1	--	--	--		1
	Iron	1	100%	636	636	--	--	--		636
	Lead	1	100%	3	3	--	--	--	[2]	3
	Lithium	NA	NA	NA	NA	--	--	--	[1]	--
	Manganese	1	100%	28	28	--	--	--		28
	Nickel	1	0%	1	1	--	--	--		1
	Nitrate	NA	NA	NA	NA	--	--	--	[1]	--
	Selenium	1	0%	2	2	--	--	--		2
	Silver	1	0%	0	0	--	--	--		0
	Strontium	1	0%	150	150	--	--	--		150
	Thallium	1	0%	2	2	--	--	--		2
	Vanadium	1	100%	1	1	--	--	--		1
	Zinc	1	100%	14	14	--	--	--		14
BMG	Aluminum	22	68%	66	279	138	lognormal	95% Chebyshev (MVUE) UCL		138
	Arsenic	2	0%	2	2	--	--	--		2
	Beryllium	2	0%	0	0	--	--	--		0.1
	Cadmium	22	5%	1	1	1	non-parametric	Mod-t UCL (Adjusted for skewness)	[3]	0.6
	Chromium	2	0%	0	0	--	--	--		0.3
	Cobalt	NA	NA	NA	NA	--	--	--	[1]	NA
	Copper	23	4%	2	6	3	non-parameteric	95% Chebyshev (Mean, Sd) UCL		3
	Cyanide	2	0%	1	1	--	--	--		1
	Iron	21	57%	90	274	161	non-parameteric	95% Chebyshev (Mean, Sd) UCL		161
	Lead	22	9%	1	4	NA	NA	NA	[2]	0.7
	Lithium	NA	NA	NA	NA	--	--	--	[1]	NA
	Manganese	2	100%	8	8	--	--	--		8
	Nickel	2	0%	1	1	--	--	--		1.0
	Nitrate	3	33%	33	50	--	--	--		50
	Selenium	3	0%	2	3	--	--	--		3
	Silver	2	0%	0	0	--	--	--		0.3
	Strontium	2	0%	150	150	--	--	--		150
	Thallium	2	0%	2	2	--	--	--		2
	Vanadium	2	0%	0	0	--	--	--		0.3
	Zinc	22	9%	26	62	30	non-parametric	Mod-t UCL (Adjusted for skewness)	[3]	30

Table D-7. Off-Site Surface Water Exposure Point Concentrations

EXPOSURE UNIT	CHEMICAL	NUMBER OF SAMPLES	DETECTION FREQUENCY	CONCENTRATION (ug/L)			DATA DISTRIBUTION	95th UCL METHOD		EXPOSURE POINT CONCENTRATION (ug/L)
				MEAN	MAX	95th UCL				
CC	Aluminum	9	33%	84	339	--	--	--		339
	Arsenic	9	0%	2	8	--	--	--		8
	Beryllium	9	0%	0	0	--	--	--		0.3
	Cadmium	9	0%	0	1	--	--	--		1
	Chromium	9	11%	1	2	--	--	--		2
	Cobalt	NA	NA	NA	NA	--	--	--	[1]	NA
	Copper	9	11%	1	8	--	--	--		8
	Cyanide	9	0%	1	4	--	--	--		4
	Iron	9	67%	176	610	--	--	--		610
	Lead	9	11%	1	3	NA	NA	NA	[2]	1
	Lithium	NA	NA	NA	NA	--	--	--	[1]	NA
	Manganese	9	100%	63	197	--	--	--		197
	Nickel	9	11%	1	4	--	--	--		4
	Nitrate	NA	NA	NA	NA	--	--	--	[1]	NA
	Selenium	9	0%	2	3	--	--	--		3
	Silver	9	11%	1	6	--	--	--		6
	Strontium	2	0%	150	150	--	--	--		150
	Thallium	9	0%	2	3	--	--	--		3
	Vanadium	9	11%	1	2	--	--	--		2
	Zinc	9	56%	13	38	--	--	--		38
HG	Aluminum	31	71%	10,456	60,400	44,894	non-parameteric	99% Chebyshev (Mean, Sd) UCL		44,894
	Arsenic	17	41%	11	66	54	non-parameteric	99% Chebyshev (Mean, Sd) UCL		54
	Beryllium	17	47%	4	11	15	non-parameteric	99% Chebyshev (Mean, Sd) UCL		11
	Cadmium	31	52%	32	179	135	non-parameteric	99% Chebyshev (Mean, Sd) UCL		135
	Chromium	17	29%	1	2	1	gamma	Approximate Gamma UCL		1.0
	Cobalt	8	63%	4	16					16
	Copper	32	84%	556	3,030	2,367	non-parameteric	99% Chebyshev (Mean, Sd) UCL		2,367
	Cyanide	17	29%	2	7	3	gamma	Approximate Gamma UCL		3
	Iron	33	91%	537	5,500	839	lognormal	95% H-UCL		839
	Lead	31	16%	2	12	NA	NA	NA	[2]	2
	Lithium	NA	NA	NA	NA	--	--	--	[1]	NA
	Manganese	17	100%	3,512	9,980	6,689	gamma	Approximate Gamma UCL		6,689
	Nickel	17	82%	106	307	236	gamma	Adjusted Gamma UCL		236
	Nitrate	1	100%	3,580	3,580	--	--	--		3,580
	Selenium	17	0%	2	2	2	normal	Student's t-UCL		2
	Silver	17	6%	1	3	1	non-parameteric	95% Chebyshev (Mean, Sd) UCL		1
	Strontium	5	80%	476	640	--	--	--		640
	Thallium	17	12%	3	7	3	non-parametric	Mod-t UCL (Adjusted for skewness)	[3]	3
	Vanadium	17	24%	2	14	9	non-parameteric	99% Chebyshev (Mean, Sd) UCL		9
	Zinc	31	77%	1,002	5,530	4,088	non-parameteric	99% Chebyshev (Mean, Sd) UCL		4,088

Table D-7. Off-Site Surface Water Exposure Point Concentrations

EXPOSURE UNIT	CHEMICAL	NUMBER OF SAMPLES	DETECTION FREQUENCY	CONCENTRATION (ug/L)			DATA DISTRIBUTION	95th UCL METHOD		EXPOSURE POINT CONCENTRATION (ug/L)
				MEAN	MAX	95th UCL				
LA	Aluminum	6	100%	34,133	44,300	--	--	--		44,300
	Arsenic	6	100%	281	699	--	--	--		699
	Beryllium	6	100%	5	6	--	--	--		6
	Cadmium	6	100%	67	70	--	--	--		70
	Chromium	6	100%	15	18	--	--	--		18
	Cobalt	NA	NA	NA	NA	--	--	--	[1]	NA
	Copper	6	100%	5,988	13,500	--	--	--		13,500
	Cyanide	6	33%	2	4	--	--	--		4
	Iron	4	100%	103,825	204,000	--	--	--		204,000
	Lead	6	67%	4	7	NA	NA	NA	[2]	4
	Lithium	NA	NA	NA	NA	--	--	--	[1]	NA
	Manganese	6	100%	2,327	2,920	--	--	--		2,920
	Nickel	6	100%	87	93	--	--	--		98
	Nitrate	NA	NA	NA	NA	--	--	--	[1]	NA
	Selenium	6	33%	4	8	--	--	--		8
	Silver	6	33%	3	7	--	--	--		7
	Strontium	2	100%	930	930	--	--	--		930
	Thallium	6	0%	4	5	--	--	--		5
	Vanadium	6	33%	3	8	--	--	--		8
	Zinc	6	100%	2,363	2,700	--	--	--		2,700
OFA	Aluminum	1	0%	16	16	--	--	--		16
	Arsenic	1	100%	5	5	--	--	--		5
	Beryllium	1	0%	0	0	--	--	--		0.1
	Cadmium	1	100%	1	1	--	--	--		1
	Chromium	1	0%	0	0	--	--	--		0.3
	Cobalt	NA	NA	NA	NA	--	--	--	[1]	NA
	Copper	2	50%	3	6	--	--	--		6
	Cyanide	1	0%	1	1	--	--	--		1
	Iron	2	100%	3,725	5,450	--	--	--		5,450
	Lead	1	0%	3	3	NA	NA	NA	[2]	3
	Lithium	NA	NA	NA	NA	--	--	--	[1]	NA
	Manganese	1	100%	1,780	1,780	--	--	--		1,780
	Nickel	1	0%	2	2	--	--	--		2
	Nitrate	NA	NA	NA	NA	--	--	--	[1]	NA
	Selenium	1	0%	2	2	--	--	--		2
	Silver	1	0%	0	0	--	--	--		0.3
	Strontium	1	100%	660	660	--	--	--		660
	Thallium	1	0%	2	2	--	--	--		2
	Vanadium	1	0%	0	0	--	--	--		0.3
	Zinc	1	100%	136	136	--	--	--		136

Table D-7. Off-Site Surface Water Exposure Point Concentrations

EXPOSURE UNIT	CHEMICAL	NUMBER OF SAMPLES	DETECTION FREQUENCY	CONCENTRATION (ug/L)			DATA DISTRIBUTION	95th UCL METHOD		EXPOSURE POINT CONCENTRATION (ug/L)
				MEAN	MAX	95th UCL				
RG	Aluminum	56	88%	6,641	90,300	24,986	lognormal	95% Chebyshev (MVUE) UCL		24,986
	Arsenic	34	3%	3	19	5	non-parameteric	95% Chebyshev (Mean, Sd) UCL		5
	Beryllium	33	27%	10	86	50	non-parameteric	99% Chebyshev (Mean, Sd) UCL		50
	Cadmium	56	54%	30	381	126	non-parameteric	99% Chebyshev (Mean, Sd) UCL		126
	Chromium	33	21%	1	13	3	non-parameteric	95% Chebyshev (Mean, Sd) UCL		3
	Cobalt	1	0%	1	1	--	--	--		0.6
	Copper	62	73%	475	7,950	2,167	non-parameteric	99% Chebyshev (Mean, Sd) UCL		2,167
	Cyanide	44	5%	4	5	5	non-parameteric	95% Chebyshev (Mean, Sd) UCL		5
	Iron	44	89%	32,810	1,420,000	353,803	non-parameteric	99% Chebyshev (Mean, Sd) UCL		353,803
	Lead	53	15%	1	6	NA	NA	NA	[2]	0.8
	Lithium	NA	NA	NA	NA	--	--	--	[1]	NA
	Manganese	33	91%	2,872	25,500	13,987	non-parameteric	99% Chebyshev (Mean, Sd) UCL		13,987
	Nickel	33	52%	87	948	422	non-parameteric	99% Chebyshev (Mean, Sd) UCL		422
	Nitrate	27	96%	1,976	9,760	2,813	gamma	Approximate Gamma UCL		2,813
	Selenium	35	6%	2	6	3	non-parametric	Mod-t UCL (Adjusted for skewness)	[3]	3
	Silver	33	0%	0	1	1	non-parametric	Mod-t UCL (Adjusted for skewness)	[3]	0.5
	Strontium	6	33%	363	1,140	--	--	--		1,140
	Thallium	13	8%	5	37	17	non-parameteric	95% Chebyshev (Mean, Sd) UCL		17
	Vanadium	13	0%	1	1	1	normal	Student's t-UCL		0.6
	Zinc	53	77%	964	11,000	2,832	lognormal	95% H-UCL		2,832
SC2	Aluminum	61	85%	590	2,690	736	gamma	Approximate Gamma UCL		736
	Arsenic	57	5%	2	5	2	non-parametric	Mod-t UCL (Adjusted for skewness)		2
	Beryllium	57	21%	0	1	0	non-parameteric	95% Chebyshev (Mean, Sd) UCL		0.2
	Cadmium	61	70%	4	29	6	lognormal	95% H-UCL		6
	Chromium	57	18%	1	5	1	non-parameteric	95% Chebyshev (Mean, Sd) UCL		1
	Cobalt	6	100%	24	62	--	--	--		62
	Copper	62	92%	52	346	66	gamma	Approximate Gamma UCL		66
	Cyanide	58	36%	4	23	7	non-parameteric	95% Chebyshev (Mean, Sd) UCL		7
	Iron	61	52%	406	3,930	1,401	non-parameteric	99% Chebyshev (Mean, Sd) UCL		1,401
	Lead	61	2%	1	36	NA	NA	NA	[2]	1
	Lithium	NA	NA	NA	NA	--	--	--	[1]	NA
	Manganese	57	100%	463	1,870	578	gamma	Approximate Gamma UCL		578
	Nickel	57	81%	9	27	10	gamma	Approximate Gamma UCL		10
	Nitrate	2	50%	1,493	2,960	--	--	--		2,960
	Selenium	58	38%	5	17	7	non-parameteric	95% Chebyshev (Mean, Sd) UCL		7
	Silver	57	5%	1	6	2	non-parameteric	95% Chebyshev (Mean, Sd) UCL		2
	Strontium	15	100%	696	860	743	non-parametric	Mod-t UCL (Adjusted for skewness)	[3]	743
	Thallium	57	2%	3	6	3	non-parametric	Mod-t UCL (Adjusted for skewness)	[3]	3
	Vanadium	57	11%	1	6	2	non-parameteric	95% Chebyshev (Mean, Sd) UCL		2
	Zinc	61	95%	112	750	169	non-parameteric	95% Chebyshev (Mean, Sd) UCL		168.8

Table D-7. Off-Site Surface Water Exposure Point Concentrations

EXPOSURE UNIT	CHEMICAL	NUMBER OF SAMPLES	DETECTION FREQUENCY	CONCENTRATION (ug/L)			DATA DISTRIBUTION	95th UCL METHOD		EXPOSURE POINT CONCENTRATION (ug/L)
				MEAN	MAX	95th UCL				
SC3	Aluminum	16	50%	220	584	377	gamma	Approximate Gamma UCL		377
	Arsenic	16	6%	2	5	2	gamma	Approximate Gamma UCL		2
	Beryllium	16	19%	0.1	0.3	0.2	normal	Student's t-UCL		0.2
	Cadmium	16	50%	2	9	4	lognormal	95% H-UCL		4
	Chromium	16	19%	1	2	1	gamma	Approximate Gamma UCL		0.8
	Cobalt	NA	NA	NA	NA	--	--	--	[1]	NA
	Copper	16	81%	18	44	24	normal	Student's t-UCL		24
	Cyanide	16	25%	3	12	5	gamma	Approximate Gamma UCL		5
	Iron	16	38%	104	823	483	lognormal	99% Chebyshev (MVUE) UCL		483
	Lead	16	0%	1	1	NA	NA	NA	[2]	0.9
	Lithium	NA	NA	NA	NA	--	--	--	[1]	NA
	Manganese	16	94%	308	1,210	549	gamma	Approximate Gamma UCL		549
	Nickel	16	81%	6	10	7	normal	Student's t-UCL		7
	Nitrate	NA	NA	NA	NA	--	--	--	[1]	NA
	Selenium	16	31%	3	12	7	non-parameteric	95% Chebyshev (Mean, Sd) UCL		7
	Silver	16	6%	1	1	1	gamma	Approximate Gamma UCL		0.7
	Strontium	4	100%	648	728	--	--	--		728
	Thallium	16	0%	3	4	3	normal	Student's t-UCL		3
	Vanadium	16	0%	1	1	1	normal	Student's t-UCL		0.6
	Zinc	16	100%	57	97	68	normal	Student's t-UCL		68
SC4	Aluminum	183	79%	243	9,030	575	non-parameteric	97.5% Chebyshev (Mean, Sd) UCL		575
	Arsenic	55	0%	2	3	2	non-parametric	Student's-t UCL	[3]	2
	Beryllium	53	2%	0.4	1	1	non-parameteric	95% Chebyshev (Mean, Sd) UCL		0.5
	Cadmium	188	43%	1	11	2	non-parameteric	95% Chebyshev (Mean, Sd) UCL		2
	Chromium	53	19%	1	5	1	non-parameteric	95% Chebyshev (Mean, Sd) UCL		1
	Cobalt	2	50%	2	2	--	--	--		2
	Copper	185	59%	14	112	22	non-parameteric	97.5% Chebyshev (Mean, Sd) UCL		22
	Cyanide	143	2%	5	7	5	non-parameteric	95% Chebyshev (Mean, Sd) UCL		5
	Iron	185	64%	210	9,600	549	non-parameteric	97.5% Chebyshev (Mean, Sd) UCL		549
	Lead	184	20%	1	21	NA	NA	NA	[2]	0.9
	Lithium	NA	NA	NA	NA	--	--	--	[1]	NA
	Manganese	55	73%	57	554	107	non-parameteric	95% Chebyshev (Mean, Sd) UCL		107
	Nickel	53	32%	4	16	7	non-parameteric	95% Chebyshev (Mean, Sd) UCL		7
	Nitrate	123	100%	12,388	50,000	21,285	non-parameteric	97.5% Chebyshev (Mean, Sd) UCL		21,285
	Selenium	56	21%	4	25	6	non-parameteric	95% Chebyshev (Mean, Sd) UCL		6
	Silver	54	4%	1	4	1	non-parametric	Mod-t UCL (Adjusted for skewness)	[3]	0.7
	Strontium	2	100%	503	514	--	--	--		514
	Thallium	11	0%	3	4	3	normal	Student's t-UCL		3
	Vanadium	11	18%	1	2	1	gamma	Approximate Gamma UCL		1
	Zinc	184	54%	58	499	112	non-parameteric	95% Chebyshev (Mean, Sd) UCL		112

Table D-7. Off-Site Surface Water Exposure Point Concentrations

EXPOSURE UNIT	CHEMICAL	NUMBER OF SAMPLES	DETECTION FREQUENCY	CONCENTRATION (ug/L)			DATA DISTRIBUTION	95th UCL METHOD		EXPOSURE POINT CONCENTRATION (ug/L)
				MEAN	MAX	95th UCL				
SCT	Aluminum	1	100%	2,440	2,440	--	--	--		2,440
	Arsenic	1	100%	24,000	24,000	--	--	--		24,000
	Beryllium	1	100%	1	1	--	--	--		1
	Cadmium	1	100%	5	5	--	--	--		5
	Chromium	1	100%	1,520	1,520	--	--	--		1,520
	Cobalt	NA	NA	NA	NA	--	--	--	[1]	NA
	Copper	1	100%	431	431	--	--	--		431
	Cyanide	1	0%	1	1	--	--	--		1
	Iron	1	100%	1,060	1,060	--	--	--		1,060
	Lead	1	0%	1	1	NA	NA	NA	[2]	0.7
	Lithium	NA	NA	NA	NA	--	--	--	[1]	NA
	Manganese	1	100%	4,830	4,830	--	--	--		4,830
	Nickel	1	100%	128	128	--	--	--		128
	Nitrate	NA	NA	NA	NA	--	--	--	[1]	NA
	Selenium	1	100%	298	298	--	--	--		298
	Silver	1	0%	0	0	--	--	--		0.3
	Strontium	1	100%	450	450	--	--	--		450
	Thallium	1	0%	2	2	--	--	--		2
	Vanadium	1	100%	440	440	--	--	--		440
	Zinc	1	100%	606	606	--	--	--		606
TG	Aluminum	10	60%	76	258	149	gamma	Approximate Gamma UCL		149
	Arsenic	7	0%	2	3	--	--	--		3
	Beryllium	6	0%	0	1	--	--	--		0.9
	Cadmium	10	0%	1	3	2	non-parameteric	95% Chebyshev (Mean, Sd) UCL		2
	Chromium	6	0%	0	1	--	--	--		0.7
	Cobalt	NA	NA	NA	NA	--	--	--	[1]	NA
	Copper	10	10%	2	3	2	normal	Student's t-UCL		2
	Cyanide	6	0%	2	3	--	--	--		3
	Iron	10	20%	37	137	72	gamma	Approximate Gamma UCL		72
	Lead	10	0%	1	1	NA	NA	NA	[2]	0.7
	Lithium	NA	NA	NA	NA	--	--	--	[1]	NA
	Manganese	7	0%	1	5	--	--	--		5
	Nickel	6	17%	1	1	--	--	--		1
	Nitrate	2	50%	67	108	--	--	--		108
	Selenium	8	0%	2	3	--	--	--		3
	Silver	6	0%	0	1	--	--	--		0.6
	Strontium	2	0%	150	150	--	--	--		150
	Thallium	6	0%	3	4	--	--	--		4
	Vanadium	6	0%	1	1	--	--	--		0.9
	Zinc	10	30%	14	25	28	gamma	Approximate Gamma UCL		25

NA = Not Applicable.
-- Due to sample size (less than 10), a 95th UCL was not calculated.

[1] Chemical not analyzed in surface water; no EPC for this chemical.
[2] Risks to lead are evaluated based on the mean concentration; a 95th UCL was not calculated.
[3] ProUCL recommended two different UCLs; the maximum value is presented.

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Table D-8. Off-Site Sediment Exposure Point Concentrations

EXPOSURE UNIT	CHEMICAL	NUMBER OF SAMPLES	DETECTION FREQUENCY	CONCENTRATION (mg/kg)			DATA DISTRIBUTION	95th UCL METHOD		EXPOSURE POINT CONCENTRATION (mg/kg)
				MEAN	MAX	95th UCL				
BBC0	Aluminum	5	1	11010	14200	--	--	--		14,200
	Antimony	5	0%	2	3	--	--	--		3
	Arsenic	5	100%	72	97	--	--	--		97
	Beryllium	5	80%	1	1	--	--	--		1
	Cadmium	5	0%	0	0	--	--	--		0
	Chromium	5	100%	19	27	--	--	--		27
	Cobalt	5	100%	21	24	--	--	--		24
	Copper	5	100%	43	55	--	--	--		55
	Iron	5	100%	36,760	43,400	--	--	--		43,400
	Lead	5	100%	46	69	--	--	--	[1]	46
	Manganese	5	100%	1,436	2,800.	--	--	--		2,800
	Nickel	5	100%	41	46	--	--	--		46
	Thallium	5	0%	1	3	--	--	--		3
	Vanadium	5	100%	30	38	--	--	--		38
	Zinc	5	100%	138	150	--	--	--		150
BBC1	Aluminum	6	100%	11,103	16,000	--	--	--		16,000
	Antimony	6	17%	2	3	--	--	--		3
	Arsenic	6	100%	75.3	126.0	--	--	--		126.0
	Beryllium	6	83%	0.8	1.2	--	--	--		1.2
	Cadmium	6	100%	2.4	5.2	--	--	--		5.2
	Chromium	6	100%	22	35	--	--	--		35
	Cobalt	6	100%	20	30	--	--	--		30
	Copper	6	100%	117	156	--	--	--		156
	Iron	6	100%	39,917	44,100	--	--	--		44,100
	Lead	6	100%	97	156	--	--	--	[1]	97
	Manganese	6	100%	1,243	2,110	--	--	--		2,110
	Nickel	6	100%	36	52	--	--	--		52
	Thallium	6	17%	1	1	--	--	--		1
	Vanadium	6	100%	31	40	--	--	--		40
	Zinc	6	100%	208	303	--	--	--		303

Table D-8. Off-Site Sediment Exposure Point Concentrations

EXPOSURE UNIT	CHEMICAL	NUMBER OF SAMPLES	DETECTION FREQUENCY	CONCENTRATION (mg/kg)			DATA DISTRIBUTION	95th UCL METHOD		EXPOSURE POINT CONCENTRATION (mg/kg)
				MEAN	MAX	95th UCL				
BBC2	Aluminum	5	100%	12,888	15,900	--	--	--		15,900
	Antimony	5	0%	2	5	--	--	--		5
	Arsenic	5	100%	63	85	--	--	--		85
	Beryllium	5	80%	1	1	--	--	--		1
	Cadmium	5	100%	4	10	--	--	--		10
	Chromium	5	100%	25	32	--	--	--		32
	Cobalt	5	100%	27	35	--	--	--		35
	Copper	5	100%	142	280	--	--	--		280
	Iron	5	100%	39,880	44,200	--	--	--		44,200
	Lead	5	100%	72	117	--	--	--	[1]	72
	Manganese	5	100%	1,586	2,340	--	--	--		2,340
	Nickel	5	100%	43	54	--	--	--		54
	Thallium	5	0%	1	1	--	--	--		1
	Vanadium	5	100%	35	41	--	--	--		41
	Zinc	5	100%	293	394	--	--	--		394
BBC3	Aluminum	5	100%	10,578	15,700	--	--	--		15,700
	Antimony	5	0%	2	3	--	--	--		3
	Arsenic	5	80%	66	189	--	--	--		189
	Beryllium	5	80%	1	2	--	--	--		2
	Cadmium	5	80%	6	16	--	--	--		16
	Chromium	5	100%	21	32	--	--	--		32
	Cobalt	5	100%	27	39	--	--	--		39
	Copper	5	100%	148	227	--	--	--		227
	Iron	5	100%	36,220	45,500	--	--	--		45,500
	Lead	5	100%	66	172	--	--	--	[1]	66
	Manganese	5	100%	2,891	8,060	--	--	--		8,060
	Nickel	5	100%	40	54	--	--	--		54
	Thallium	5	40%	1	2	--	--	--		2
	Vanadium	5	100%	31	44	--	--	--		44
	Zinc	5	100%	252	492	--	--	--		492

Table D-8. Off-Site Sediment Exposure Point Concentrations

EXPOSURE UNIT	CHEMICAL	NUMBER OF SAMPLES	DETECTION FREQUENCY	CONCENTRATION (mg/kg)			DATA DISTRIBUTION	95th UCL METHOD		EXPOSURE POINT CONCENTRATION (mg/kg)
				MEAN	MAX	95th UCL				
BBC4	Aluminum	5	100%	9,536	11,700	--	--	--		11,700
	Antimony	5	40%	3	7	--	--	--		7
	Arsenic	5	100%	148	352	--	--	--		352
	Beryllium	5	80%	1	1	--	--	--		1
	Cadmium	5	100%	3	7	--	--	--		7
	Chromium	5	100%	20	24	--	--	--		24
	Cobalt	5	100%	20	26	--	--	--		26
	Copper	5	100%	121	149	--	--	--		149
	Iron	5	100%	39,280	42,900	--	--	--		42,900
	Lead	5	100%	555	2,120	--	--	--	[1]	555
	Manganese	5	100%	1,020	1,550	--	--	--		1,550
	Nickel	5	100%	40	50	--	--	--		50
	Thallium	5	20%	1	2	--	--	--		2
	Vanadium	5	100%	63	138	--	--	--		138
	Zinc	5	100%	430	970	--	--	--		970
BHG	Aluminum	5	100%	6,356	11,300	--	--	--		11,300
	Antimony	5	0%	1	2	--	--	--		2
	Arsenic	5	60%	8	16	--	--	--		16
	Beryllium	5	100%	1	1	--	--	--		1
	Cadmium	5	40%	0	0	--	--	--		0
	Chromium	5	100%	14	32	--	--	--		32
	Cobalt	5	100%	4	8	--	--	--		8
	Copper	5	100%	15	31	--	--	--		31
	Iron	5	100%	12,478	20,200	--	--	--		20,200
	Lead	5	100%	34	83	--	--	--	[1]	34
	Manganese	5	100%	532	698	--	--	--		698
	Nickel	5	100%	11	29	--	--	--		29
	Thallium	5	0%	0	1	--	--	--		1
	Vanadium	5	100%	15	32	--	--	--		32
	Zinc	5	100%	70	105	--	--	--		105

Table D-8. Off-Site Sediment Exposure Point Concentrations

EXPOSURE UNIT	CHEMICAL	NUMBER OF SAMPLES	DETECTION FREQUENCY	CONCENTRATION (mg/kg)			DATA DISTRIBUTION	95th UCL METHOD		EXPOSURE POINT CONCENTRATION (mg/kg)
				MEAN	MAX	95th UCL				
BKD1	Aluminum	1	100%	11,500	11,500	--	--	--		11,500
	Antimony	1	100%	2	2	--	--	--		2
	Arsenic	1	100%	64.0	64.0	--	--	--		64.0
	Beryllium	1	100%	0.8	0.8	--	--	--		0.8
	Cadmium	1	100%	0.9	0.9	--	--	--		0.9
	Chromium	1	100%	16	16	--	--	--		16
	Cobalt	1	100%	7	7	--	--	--		7
	Copper	1	100%	26	26	--	--	--		26
	Iron	1	100%	18,700	18,700	--	--	--		18,700
	Lead	1	100%	54	54	NA	NA	NA	[1]	54
	Manganese	1	100%	459	459	--	--	--		459
	Nickel	1	100%	13	13	--	--	--		13
	Thallium	1	0%	1	1	--	--	--		1
	Vanadium	1	100%	30	30	--	--	--		30
	Zinc	1	100%	113	113	--	--	--		113
BMG	Aluminum	3	100%	20,600	26,600	--	--	--		26,600
	Antimony	3	0%	2	4	--	--	--		4
	Arsenic	4	100%	11	14	--	--	--		14
	Beryllium	3	100%	1	1	--	--	--		1
	Cadmium	4	75%	1	2	--	--	--		2
	Chromium	3	100%	39	45	--	--	--		45
	Cobalt	3	100%	27	38	--	--	--		38
	Copper	4	100%	42	49	--	--	--		49
	Iron	3	100%	43,533	57,800	--	--	--		57,800
	Lead	4	100%	40	51	--	--	--	[1]	40
	Manganese	3	100%	1,233	1,470	--	--	--		1,470
	Nickel	3	100%	60	77	--	--	--		77
	Thallium	3	0%	1	2	--	--	--		2
	Vanadium	3	100%	50	65	--	--	--		65
	Zinc	4	100%	224	289	--	--	--		289

Table D-8. Off-Site Sediment Exposure Point Concentrations

EXPOSURE UNIT	CHEMICAL	NUMBER OF SAMPLES	DETECTION FREQUENCY	CONCENTRATION (mg/kg)			DATA DISTRIBUTION	95th UCL METHOD		EXPOSURE POINT CONCENTRATION (mg/kg)
				MEAN	MAX	95th UCL				
CC	Aluminum	3	100%	11,837	17,500	--	--	--		17,500
	Antimony	3	0%	2	6	--	--	--		6
	Arsenic	3	100%	19	21	--	--	--		21
	Beryllium	3	67%	1	1	--	--	--		1
	Cadmium	3	100%	1	1	--	--	--		1
	Chromium	3	100%	14	19	--	--	--		19
	Cobalt	3	100%	9	11	--	--	--		11
	Copper	3	100%	18	23	--	--	--		23
	Iron	3	100%	20,867	21,100	--	--	--		21,100
	Lead	3	100%	62	99	--	--	--	[1]	62
	Manganese	3	100%	1,189	1,720	--	--	--		1,720
	Nickel	3	100%	16	17	--	--	--		17
	Thallium	3	0%	1	1	--	--	--		1
	Vanadium	3	100%	27	33	--	--	--		33
	Zinc	3	100%	124	152	--	--	--		152
HG	Aluminum	8	100%	19,816	69,800	--	--	--		69,800
	Antimony	8	0%	3	16	--	--	--		16
	Arsenic	8	100%	71	187	--	--	--		187
	Beryllium	8	88%	2	4	--	--	--		4
	Cadmium	8	100%	18	42	--	--	--		42
	Chromium	8	100%	23	60	--	--	--		60
	Cobalt	8	100%	39	93	--	--	--		93
	Copper	8	100%	346	805	--	--	--		805
	Iron	8	100%	24,213	38,700	--	--	--		38,700
	Lead	8	100%	124	284	--	--	--	[1]	124
	Manganese	8	100%	2,037	4,640	--	--	--		4,640
	Nickel	8	100%	62	132	--	--	--		132
	Thallium	8	0%	1	3	--	--	--		3
	Vanadium	8	88%	30	65	--	--	--		65
	Zinc	8	100%	682	1,380	--	--	--		1,380

Table D-6. Off-Site Sediment Exposure Point Concentrations

EXPOSURE UNIT	CHEMICAL	NUMBER OF SAMPLES	DETECTION FREQUENCY	CONCENTRATION (mg/kg)			DATA DISTRIBUTION	95th UCL METHOD		EXPOSURE POINT CONCENTRATION (mg/kg)
				MEAN	MAX	95th UCL				
LA	Aluminum	1	100%	5,210	5,210	--	--	--		5,210
	Antimony	1	100%	1	1	--	--	--		1
	Arsenic	1	100%	253	253	--	--	--		253
	Beryllium	1	0%	1	1	--	--	--		1
	Cadmium	1	100%	2	2	--	--	--		2
	Chromium	1	100%	8	8	--	--	--		8
	Cobalt	1	100%	4	4	--	--	--		4
	Copper	1	100%	122	122	--	--	--		122
	Iron	1	100%	27,600	27,600	--	--	--		27,600
	Lead	1	100%	207	207	--	--	--	[1]	207
	Manganese	1	100%	778	778	--	--	--		778
	Nickel	1	100%	8	8	--	--	--		8
	Thallium	1	0%	1	1	--	--	--		1
	Vanadium	1	100%	18	18	--	--	--		18
	Zinc	1	100%	144	144	--	--	--		144
OFA	Aluminum	1	100%	1,140	1,140	--	--	--		1,140
	Antimony	1	0%	80	80	--	--	--		80
	Arsenic	1	100%	192	192	--	--	--		192
	Beryllium	1	0%	1	1	--	--	--		1
	Cadmium	1	100%	11	11	--	--	--		11
	Chromium	1	100%	14	14	--	--	--		14
	Cobalt	1	100%	16	16	--	--	--		16
	Copper	1	100%	90	90	--	--	--		90
	Iron	1	100%	155,000	155,000	--	--	--		155,000
	Lead	1	100%	80	80	--	--	--	[1]	80
	Manganese	1	100%	15,400	15,400	--	--	--		15,400
	Nickel	1	0%	8	8	--	--	--		8
	Thallium	1	0%	16	16	--	--	--		16
	Vanadium	1	0%	10	10	--	--	--		10
	Zinc	1	100%	1,260	1,260	--	--	--		1,260

Table D-8. Off-Site Sediment Exposure Point Concentrations

EXPOSURE UNIT	CHEMICAL	NUMBER OF SAMPLES	DETECTION FREQUENCY	CONCENTRATION (mg/kg)			DATA DISTRIBUTION	95th UCL METHOD		EXPOSURE POINT CONCENTRATION (mg/kg)
				MEAN	MAX	95th UCL				
RG	Aluminum	8	100%	8,788	15,400	--	--	--		15,400
	Antimony	8	0%	2	3	--	--	--		3
	Arsenic	8	88%	45	139	--	--	--		139
	Beryllium	8	88%	1	1	--	--	--		1
	Cadmium	8	88%	1	2	--	--	--		2
	Chromium	8	100%	22	46	--	--	--		46
	Cobalt	8	100%	9	13	--	--	--		13
	Copper	8	100%	126	295	--	--	--		295
	Iron	8	100%	29,975	49,700	--	--	--		49,700
	Lead	8	100%	50	121	--	--	--	[1]	50
	Manganese	8	100%	509	817	--	--	--		817
	Nickel	8	100%	21	32	--	--	--		32
	Thallium	8	13%	1	2	--	--	--		2
	Vanadium	8	100%	25	44	--	--	--		44
	Zinc	8	100%	151	255	--	--	--		255
SC2	Aluminum	39	100%	29,214	130,000	48,606	lognormal	95% H-UCL		48,606
	Antimony	39	26%	5	33	10	non-parameteric	95% Chebyshev (Mean, Sd) UCL		10
	Arsenic	42	98%	109	299	127	gamma	Approximate Gamma UCL		127
	Beryllium	39	82%	2	8	2	gamma	Approximate Gamma UCL		2
	Cadmium	42	81%	9	71	14	gamma	Adjusted Gamma UCL		14
	Chromium	39	100%	20	65	24	gamma	Approximate Gamma UCL		24
	Cobalt	39	97%	39	181	55	gamma	Approximate Gamma UCL		55
	Copper	42	100%	1,720	10,900	6,134	non-parameteric	99% Chebyshev (Mean, Sd) UCL		6,134
	Iron	39	100%	40,026	76,500	43,772	normal	Student's t-UCL		43,772
	Lead	42	100%	135	706	NA	NA	NA	[1]	135
	Manganese	39	100%	1,547	7,710	2,016	gamma	Approximate Gamma UCL		2,016
	Nickel	39	100%	45	159	59	gamma	Approximate Gamma UCL		59
	Thallium	39	46%	2	7	3	gamma	Approximate Gamma UCL		3
	Vanadium	39	100%	35	83	40	gamma	Approximate Gamma UCL		40
	Zinc	42	98%	721	3,230	2,153	non-parameteric	99% Chebyshev (Mean, Sd) UCL		2,153

Table D-8. Off-Site Sediment Exposure Point Concentrations

EXPOSURE UNIT	CHEMICAL	NUMBER OF SAMPLES	DETECTION FREQUENCY	CONCENTRATION (mg/kg)			DATA DISTRIBUTION	95th UCL METHOD		EXPOSURE POINT CONCENTRATION (mg/kg)
				MEAN	MAX	95th UCL				
SC3	Aluminum	10	100%	14,261	43,700	20,919	non-parametric	Mod-t UCL (Adjusted for skewness)	[2]	20,919
	Antimony	10	20%	3	16	7	gamma	Approximate Gamma UCL		7
	Arsenic	10	100%	94	179	125	normal	Student's t-UCL		125
	Beryllium	10	70%	1	2	1	gamma	Approximate Gamma UCL		1
	Cadmium	10	90%	5	10	7	normal	Student's t-UCL		7
	Chromium	10	100%	18	24	21	normal	Student's t-UCL		21
	Cobalt	10	100%	24	37	29	normal	Student's t-UCL		29
	Copper	10	100%	607	1,950	1,115	gamma	Approximate Gamma UCL		1,115
	Iron	10	100%	40,260	69,700	49,421	normal	Student's t-UCL		49,421
	Lead	10	100%	266	1,230	NA	NA	NA	[1]	266
	Manganese	10	100%	1,329	2,320	1,759	normal	Student's t-UCL		1,759
	Nickel	10	100%	32	54	37	normal	Student's t-UCL		37
	Thallium	10	50%	2	4	3	normal	Student's t-UCL		3
	Vanadium	10	100%	40	83	51	normal	Student's t-UCL		51
	Zinc	10	100%	402	870	549	normal	Student's t-UCL		549
SC4	Aluminum	6	100%	17,350	28,000	--	--	--		28,000
	Antimony	6	0%	2	4	--	--	--		4
	Arsenic	9	100%	68	165	--	--	--		165
	Beryllium	6	67%	1	3	--	--	--		3
	Cadmium	9	78%	18	33	--	--	--		33
	Chromium	6	100%	26	35	--	--	--		35
	Cobalt	6	100%	51	90	--	--	--		90
	Copper	9	100%	537	987	--	--	--		987
	Iron	6	100%	39,450	57,200	--	--	--		57,200
	Lead	9	100%	175	726	--	--	--	[1]	175
	Manganese	6	100%	3,788	7,750	--	--	--		7,750
	Nickel	6	100%	77	173	--	--	--		173
	Thallium	6	17%	1	3	--	--	--		3
	Vanadium	6	100%	42	50	--	--	--		50
	Zinc	9	100%	737	1,310	--	--	--		1,310

Table D-8. Off-Site Sediment Exposure Point Concentrations

EXPOSURE UNIT	CHEMICAL	NUMBER OF SAMPLES	DETECTION FREQUENCY	CONCENTRATION (mg/kg)			DATA DISTRIBUTION	95th UCL METHOD		EXPOSURE POINT CONCENTRATION (mg/kg)
				MEAN	MAX	95th UCL				
TG	Aluminum	3	100%	8,087	12,700	--	--	--	[1]	12,700
	Antimony	3	33%	3	5	--	--	--		5
	Arsenic	3	33%	4	6	--	--	--		6
	Beryllium	3	100%	2	3	--	--	--		3
	Cadmium	3	0%	0	0	--	--	--		0
	Chromium	3	100%	21	25	--	--	--		25
	Cobalt	3	100%	5	6	--	--	--		6
	Copper	3	100%	22	32	--	--	--		32
	Iron	3	100%	12,283	15,500	--	--	--		15,500
	Lead	3	100%	15	26	--	--	--		15
	Manganese	3	100%	175	280	--	--	--		280
	Nickel	3	100%	18	24	--	--	--		24
	Thallium	3	0%	2	4	--	--	--		4
	Vanadium	3	100%	29	46	--	--	--		46
	Zinc	3	100%	47	66	--	--	--		66

NA = Not Applicable.
-- Due to sample size (less than 10), a 95th UCL was not calculated.

[1] Risks to lead are evaluated based on the mean concentration; a 95th UCL was not calculated.
[2] ProUCL recommended two different UCLs; the maximum value is presented.

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Table D-9. Fish Tissue Exposure Point Concentrations

EXPOSURE UNIT	CHEMICAL	NUMBER OF SAMPLES	DETECTION FREQUENCY	CONCENTRATION (mg/kg ww)			DATA DISTRIBUTION	95th UCL METHOD	EXPOSURE POINT CONCENTRATION (mg/kg ww)
				MEAN	MAX	95th UCL			
BBC0	Aluminum	18	50%	24.7	153.9	41.0	Lognormal	95th H-UCL	41.0
	Arsenic	18	83%	0.5	1.4	0.7	Gamma	Approximate Gamma UCL	0.7
	Cadmium	18	6%	0.2	0.5	0.4	Non-parametric	95% Chebyshev UCL	0.4
	Chromium	18	22%	0.5	1.0	0.9	Non-parametric	95% Chebyshev UCL	0.9
	Cobalt	18	17%	2.1	5.0	7.2	Non-parametric	99% Chebyshev UCL	7.2
	Iron	18	72%	87.8	401.4	152.9	Gamma	Approximate Gamma UCL	152.9
	Manganese	18	100%	14.9	62.4	23.1	Gamma	Approximate Gamma UCL	23.1
	Mercury	18	78%	0.04	0.1	0.0	Normal	Student's-t UCL	0.05
	Nickel	18	6%	1.9	4.0	3.5	Non-parametric	95% Chebyshev UCL	3.5
	Selenium	18	100%	0.8	1.6	1.0	Normal	Student's-t UCL	1.0
	Zinc	18	100%	26.2	45.4	31.6	Normal	Student's-t UCL	31.6
BBC1	Aluminum	9	78%	46.8	164.2	–	–	–	164.2
	Arsenic	9	78%	0.5	1.1	–	–	–	1.1
	Cadmium	9	100%	0.4	0.6	–	–	–	0.6
	Chromium	9	89%	0.3	0.6	–	–	–	0.6
	Cobalt	9	67%	0.2	0.4	–	–	–	0.4
	Iron	9	100%	121.5	380.8	–	–	–	380.8
	Manganese	9	100%	27.0	73.7	–	–	–	73.7
	Mercury	9	67%	0.01	0.02	–	–	–	0.0
	Nickel	9	0%	0.8	1.6	–	–	–	1.6
	Selenium	9	100%	0.8	1.3	–	–	–	1.3
	Zinc	9	100%	31.1	40.5	–	–	–	40.5
BBC2	Aluminum	9	44%	15.7	92.7	–	–	–	92.7
	Arsenic	9	89%	0.6	0.9	–	–	–	0.9
	Cadmium	9	100%	0.5	0.9	–	–	–	0.9
	Chromium	9	22%	0.2	0.4	–	–	–	0.4
	Cobalt	9	33%	0.8	2.0	–	–	–	2.0
	Iron	9	89%	79.6	212.3	–	–	–	212.3
	Manganese	9	100%	24.6	63.4	–	–	–	63.4
	Mercury	9	89%	0.02	0.03	–	–	–	0.0
	Nickel	9	0%	0.8	1.6	–	–	–	1.6
	Selenium	9	100%	0.8	1.3	–	–	–	1.3
	Zinc	9	100%	30.4	42.2	–	–	–	42.2

Table D-9. Fish Tissue Exposure Point Concentrations

EXPOSURE UNIT	CHEMICAL	NUMBER OF SAMPLES	DETECTION FREQUENCY	CONCENTRATION (mg/kg ww)			DATA DISTRIBUTION	95th UCL METHOD	EXPOSURE POINT CONCENTRATION (mg/kg ww)
				MEAN	MAX	95th UCL			
BBC3	Aluminum	9	22%	31.9	164.2	--	--	--	164.2
	Arsenic	9	44%	0.4	1.0	--	--	--	1.0
	Cadmium	9	100%	0.5	1.0	--	--	--	1.0
	Chromium	9	22%	0.5	1.8	--	--	--	1.8
	Cobalt	9	0%	1.1	1.9	--	--	--	1.9
	Iron	9	100%	121.2	410.4	--	--	--	410.4
	Manganese	9	100%	30.6	101.5	--	--	--	101.5
	Mercury	9	100%	0.03	0.04	--	--	--	0.0
	Nickel	9	22%	0.9	1.5	--	--	--	1.5
	Selenium	9	100%	1.0	1.6	--	--	--	1.6
	Zinc	9	100%	33.5	47.5	--	--	--	47.5
BBC4	Aluminum	6	17%	4.3	7.8	--	--	--	7.8
	Arsenic	6	83%	0.5	0.9	--	--	--	0.9
	Cadmium	6	100%	0.2	0.3	--	--	--	0.3
	Chromium	6	33%	4.4	24.5	--	--	--	24.5
	Cobalt	6	0%	1.0	2.0	--	--	--	2.0
	Iron	6	83%	42.6	98.1	--	--	--	98.1
	Manganese	6	83%	4.7	7.8	--	--	--	7.8
	Mercury	6	100%	0.03	0.04	--	--	--	0.0
	Nickel	6	17%	3.6	17.3	--	--	--	17.3
	Selenium	6	100%	0.8	1.1	--	--	--	1.1
	Zinc	6	100%	26.2	32.2	--	--	--	32.2
BMG	Aluminum	3	33%	17.3	40.0	--	--	--	40.0
	Arsenic	3	67%	0.4	0.4	--	--	--	0.4
	Cadmium	3	0%	0.1	0.2	--	--	--	0.2
	Chromium	3	0%	0.3	0.4	--	--	--	0.4
	Cobalt	3	0%	1.3	2.0	--	--	--	2.0
	Iron	3	100%	49.1	96.4	--	--	--	96.4
	Manganese	3	100%	4.7	6.1	--	--	--	6.1
	Mercury	3	0%	0.004	0.01	--	--	--	0.0
	Nickel	3	0%	1.1	1.6	--	--	--	1.6
	Selenium	3	100%	1.3	1.3	--	--	--	1.3
	Zinc	3	100%	24.5	26.6	--	--	--	26.6

Table D-9. Fish Tissue Exposure Point Concentrations

EXPOSURE UNIT	CHEMICAL	NUMBER OF SAMPLES	DETECTION FREQUENCY	CONCENTRATION (mg/kg ww)			DATA DISTRIBUTION	95th UCL METHOD	EXPOSURE POINT CONCENTRATION (mg/kg ww)
				MEAN	MAX	95th UCL			
SC2	Aluminum	3	0%	20.0	20.0	–	–	–	20.0
	Arsenic	3	100%	0.9	1.0	–	–	–	1.0
	Cadmium	3	67%	0.3	0.5	–	–	–	0.5
	Chromium	3	0%	1.0	1.0	–	–	–	1.0
	Cobalt	3	0%	5.0	5.0	–	–	–	5.0
	Iron	3	67%	43.9	61.4	–	–	–	61.4
	Manganese	3	100%	8.0	11.8	–	–	–	11.8
	Mercury	3	33%	0.03	0.04	–	–	–	0.0
	Nickel	3	0%	4.0	4.0	–	–	–	4.0
	Selenium	3	100%	1.1	1.2	–	–	–	1.2
	Zinc	3	100%	24.8	28.2	–	–	–	28.2
SC4	Aluminum	6	0%	20.0	20.0	–	–	–	20.0
	Arsenic	6	67%	0.5	1.0	–	–	–	1.0
	Cadmium	6	83%	0.4	0.5	–	–	–	0.5
	Chromium	6	0%	1.0	1.0	–	–	–	1.0
	Cobalt	6	0%	5.0	5.0	–	–	–	5.0
	Iron	6	67%	55.7	96.8	–	–	–	96.8
	Manganese	6	100%	16.7	26.0	–	–	–	26.0
	Mercury	6	50%	0.04	0.1	–	–	–	0.1
	Nickel	6	0%	4.0	4.0	–	–	–	4.0
	Selenium	6	100%	1.1	1.6	–	–	–	1.6
	Zinc	6	100%	31.9	42.7	–	–	–	42.7

– Due to sample size (less than 10), a 95th UCL was not calculated

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Table D-10. Off-Site Groundwater Exposure Point Concentrations (Dissolved Fraction)

EXPOSURE UNIT	CHEMICAL	NUMBER OF SAMPLES	DETECTION FREQUENCY	CONCENTRATION (ug/L)			DATA DISTRIBUTION	95th UCL METHOD		EXPOSURE POINT CONCENTRATION (ug/L)
				MEAN	MAX	95th UCL				
BED11	Aluminum	8	13%	41	105	--	--	--		105
	Antimony	8	0%	7	30	--	--	--		30
	Arsenic	8	13%	3	8	--	--	--		8
	Beryllium	8	13%	0.5	3	--	--	--		3
	Cadmium	8	0%	0.6	3	--	--	--		3
	Chromium	8	13%	2	6	--	--	--		6
	Cobalt	NA	NA	NA	NA	--	--	--	[1]	--
	Copper	8	50%	8	25	--	--	--		25
	Iron	8	63%	100	239	--	--	--		239
	Lead	8	13%	2	5	--	--	--	[2]	2
	Manganese	8	100%	1,030	2,340	--	--	--		2,340
	Mercury	8	0%	0.1	0.1	--	--	--		0.1
	Nickel	8	75%	8	40	--	--	--		40
	Nitrate	NA	NA	NA	NA	--	--	--	[1]	--
	Nitrite	NA	NA	NA	NA	--	--	--	[1]	--
	Selenium	8	0%	4	18	--	--	--		18
	Silver	8	0%	1	5	--	--	--		5
	Thallium	8	13%	4	13	--	--	--		13
	Vanadium	8	0%	4	25	--	--	--		25
	Zinc	8	100%	118	462	--	--	--		462
BED-14	Aluminum	6	50%	39	100	--	--	--		100
	Antimony	2	0%	16	30	--	--	--		30
	Arsenic	2	0%	4.8	7.5	--	--	--		7.5
	Beryllium	2	0%	1.4	2.5	--	--	--		2.5
	Cadmium	6	0%	0.8	2.5	--	--	--		2.5
	Chromium	2	0%	3	5	--	--	--		5
	Cobalt	2	0%	1	2	--	--	--		2
	Copper	6	17%	4	13	--	--	--		13
	Iron	6	17%	48	138	--	--	--		138
	Lead	6	0%	1	3	--	--	--	[2]	1
	Manganese	2	100%	409	488	--	--	--		488
	Mercury	2	0%	0	0	--	--	--		0
	Nickel	2	50%	3	4	--	--	--		4
	Nitrate	NA	NA	NA	NA	--	--	--	[1]	--
	Nitrite	NA	NA	NA	NA	--	--	--	[1]	--
	Selenium	3	0%	2	3	--	--	--		3
	Silver	2	0%	3	5	--	--	--		5
	Thallium	2	0%	8	13	--	--	--		13
	Vanadium	2	50%	1	1	--	--	--		1
	Zinc	6	50%	49	78	--	--	--		78

Table D-10. Off-Site Groundwater Exposure Point Concentrations
(Dissolved Fraction)

EXPOSURE UNIT	CHEMICAL	NUMBER OF SAMPLES	DETECTION FREQUENCY	CONCENTRATION (ug/L)			DATA DISTRIBUTION	95th UCL METHOD		EXPOSURE POINT CONCENTRATION (ug/L)
				MEAN	MAX	95th UCL				
BED-19	Aluminum	4	100%	305	763	--	--	--		763
	Antimony	NA	NA	NA	NA	--	--	--	[1]	--
	Arsenic	NA	NA	NA	NA	--	--	--	[1]	--
	Beryllium	NA	NA	NA	NA	--	--	--	[1]	--
	Cadmium	4	25%	1	1	--	--	--		1
	Chromium	NA	NA	NA	NA	--	--	--	[1]	--
	Cobalt	NA	NA	NA	NA	--	--	--	[1]	--
	Copper	4	100%	72	83	--	--	--		83
	Iron	4	75%	137	304	--	--	--		304
	Lead	4	100%	34	49	--	--	--	[2]	34
	Manganese	NA	NA	NA	NA	--	--	--	[1]	--
	Mercury	NA	NA	NA	NA	--	--	--	[1]	--
	Nickel	NA	NA	NA	NA	--	--	--	[1]	--
	Nitrate	NA	NA	NA	NA	--	--	--	[1]	--
	Nitrite	NA	NA	NA	NA	--	--	--	[1]	--
	Selenium	1	0%	3	3	--	--	--		3
	Silver	NA	NA	NA	NA	--	--	--	[1]	--
	Thallium	NA	NA	NA	NA	--	--	--	[1]	--
	Vanadium	NA	NA	NA	NA	--	--	--	[1]	--
	Zinc	4	50%	89	173	--	--	--		173
BED-7	Aluminum	6	83%	187	713	--	--	--		713
	Antimony	2	100%	10	11	--	--	--		11
	Arsenic	2	50%	13.1	14.0	--	--	--		14.0
	Beryllium	2	0%	1.4	2.5	--	--	--		2.5
	Cadmium	6	0%	0.8	2.5	--	--	--		2.5
	Chromium	2	0%	3	5	--	--	--		5
	Cobalt	2	0%	13	25	--	--	--		25
	Copper	6	17%	2	3	--	--	--		3
	Iron	6	17%	70	278	--	--	--		278
	Lead	6	0%	1	3	--	--	--	[2]	1
	Manganese	2	50%	4	8	--	--	--		8
	Mercury	2	0%	0	0	--	--	--		0
	Nickel	2	50%	12	20	--	--	--		20
	Nitrate	NA	NA	NA	NA	--	--	--	[1]	--
	Nitrite	NA	NA	NA	NA	--	--	--	[1]	--
	Selenium	3	0%	3	6	--	--	--		6
	Silver	2	0%	3	5	--	--	--		5
	Thallium	2	0%	8	13	--	--	--		13
	Vanadium	2	100%	32	38	--	--	--		38
	Zinc	6	17%	22	28	--	--	--		28

Table D-10. Off-Site Groundwater Exposure Point Concentrations
(Dissolved Fraction)

EXPOSURE UNIT	CHEMICAL	NUMBER OF SAMPLES	DETECTION FREQUENCY	CONCENTRATION (ug/L)			DATA DISTRIBUTION	95th UCL METHOD		EXPOSURE POINT CONCENTRATION (ug/L)
				MEAN	MAX	95th UCL				
BES-11	Aluminum	12	25%	33	130	61	gamma	Approximate Gamma UCL		61
	Antimony	8	0%	5	30	2	normal	Student's t-UCL		2
	Arsenic	8	0%	3	8	--	--	--		8
	Beryllium	8	0%	1	3	--	--	--		3
	Cadmium	12	50%	1	3	--	--	--		3
	Chromium	8	13%	1	5	--	--	--		5
	Cobalt	8	63%	10	27	--	--	--		27
	Copper	12	42%	6	13	8	normal	Student's t-UCL		8
	Iron	12	67%	174	1,200	408	gamma	Approximate Gamma UCL		408
	Lead	12	8%	1	5	NA	NA	NA	[2]	1
	Manganese	8	75%	95	579	--	--	--		579
	Mercury	8	0%	0	0	--	--	--		0
	Nickel	8	75%	10	20	--	--	--		20
	Nitrate	NA	NA	NA	NA	--	--	--	[1]	--
	Nitrite	NA	NA	NA	NA	--	--	--	[1]	--
	Selenium	9	22%	3	6	--	--	--		6
	Silver	8	0%	1	5	--	--	--		5
	Thallium	8	0%	4	13	--	--	--		13
	Vanadium	8	0%	4	25	--	--	--		25
	Zinc	12	100%	414	904	542	normal	Student's t-UCL		542
BES-14	Aluminum	6	33%	38	180	--	--	--		180
	Antimony	2	0%	16	30	--	--	--		30
	Arsenic	2	50%	6	8	--	--	--		8
	Beryllium	2	0%	1	3	--	--	--		3
	Cadmium	6	17%	1	3	--	--	--		3
	Chromium	2	0%	3	5	--	--	--		5
	Cobalt	2	0%	13	25	--	--	--		25
	Copper	6	50%	9	32	--	--	--		32
	Iron	6	100%	488	1,920	--	--	--		1,920
	Lead	6	0%	1	3	--	--	--	[2]	1
	Manganese	2	100%	57	105	--	--	--		105
	Mercury	2	0%	0	0	--	--	--		0
	Nickel	2	50%	19	20	--	--	--		20
	Nitrate	NA	NA	NA	NA	--	--	--	[1]	--
	Nitrite	NA	NA	NA	NA	--	--	--	[1]	--
	Selenium	3	0%	3	6	--	--	--		6
	Silver	2	0%	3	5	--	--	--		5
	Thallium	2	0%	8	13	--	--	--		13
	Vanadium	2	0%	13	25	--	--	--		25
	Zinc	6	50%	72	169	--	--	--		169

Table D-10. Off-Site Groundwater Exposure Point Concentrations (Dissolved Fraction)

EXPOSURE UNIT	CHEMICAL	NUMBER OF SAMPLES	DETECTION FREQUENCY	CONCENTRATION (ug/L)			DATA DISTRIBUTION	95th UCL METHOD		EXPOSURE POINT CONCENTRATION (ug/L)
				MEAN	MAX	95th UCL				
BES-17	Aluminum	7	43%	33	100	–	–	–		100
	Antimony	2	0%	16	30	–	–	–		30
	Arsenic	2	100%	21	37	–	–	–		37
	Beryllium	2	0%	1	3	–	–	–		3
	Cadmium	7	0%	1	3	–	–	–		3
	Chromium	2	0%	3	5	–	–	–		5
	Cobalt	2	50%	13	15	–	–	–		15
	Copper	7	0%	4	13	–	–	–		13
	Iron	7	100%	3,457	4,900	–	–	–		4,900
	Lead	7	0%	2	12	–	–	–	[2]	2
	Manganese	2	100%	520	619	–	–	–		619
	Mercury	2	0%	0	0	–	–	–		0
	Nickel	2	100%	10	11	–	–	–		11
	Nitrate	NA	NA	NA	NA	–	–	–	[1]	–
	Nitrite	NA	NA	NA	NA	–	–	–	[1]	–
	Selenium	3	0%	7	18	–	–	–		18
	Silver	2	0%	3	5	–	–	–		5
	Thallium	2	0%	8	13	–	–	–		13
	Vanadium	2	0%	13	25	–	–	–		25
	Zinc	7	43%	69	150	–	–	–		150
CDM06b	Aluminum	1	100%	894	894	–	–	–		894
	Antimony	NA	NA	NA	NA	–	–	–	[1]	–
	Arsenic	NA	NA	NA	NA	–	–	–	[1]	–
	Beryllium	NA	NA	NA	NA	–	–	–	[1]	–
	Cadmium	1	100%	10	10	–	–	–		10
	Chromium	NA	NA	NA	NA	–	–	–	[1]	–
	Cobalt	NA	NA	NA	NA	–	–	–	[1]	–
	Copper	1	100%	48	48	–	–	–		48
	Iron	1	100%	495	495	–	–	–		495
	Lead	1	100%	1	1	–	–	–	[2]	1
	Manganese	NA	NA	NA	NA	–	–	–	[1]	–
	Mercury	NA	NA	NA	NA	–	–	–	[1]	–
	Nickel	NA	NA	NA	NA	–	–	–	[1]	–
	Nitrate	NA	NA	NA	NA	–	–	–	[1]	–
	Nitrite	NA	NA	NA	NA	–	–	–	[1]	–
	Selenium	1	0%	3	3	–	–	–		3
	Silver	NA	NA	NA	NA	–	–	–	[1]	–
	Thallium	NA	NA	NA	NA	–	–	–	[1]	–
	Vanadium	NA	NA	NA	NA	–	–	–	[1]	–
	Zinc	1	100%	337	337	–	–	–		337

Table D-10. Off-Site Groundwater Exposure Point Concentrations (Dissolved Fraction)

EXPOSURE UNIT	CHEMICAL	NUMBER OF SAMPLES	DETECTION FREQUENCY	CONCENTRATION (ug/L) MEAN	MAX	95th UCL	DATA DISTRIBUTION	95th UCL METHOD		EXPOSURE POINT CONCENTRATION (ug/L)
GE-MW-18	Aluminum	3	100%	74	152	–	–	–		152
	Antimony	NA	NA	NA	NA	–	–	–	[1]	–
	Arsenic	1	0%	3	3	–	–	–		3
	Beryllium	NA	NA	NA	NA	–	–	–	[1]	–
	Cadmium	3	0%	1	1	–	–	–		1
	Chromium	NA	NA	NA	NA	–	–	–	[1]	–
	Cobalt	NA	NA	NA	NA	–	–	–	[1]	–
	Copper	3	0%	3	3	–	–	–		3
	Iron	3	100%	110	177	–	–	–		177
	Lead	3	0%	1	1	–	–	–	[2]	1
	Manganese	1	100%	637	637	–	–	–		637
	Mercury	NA	NA	NA	NA	–	–	–	[1]	–
	Nickel	NA	NA	NA	NA	–	–	–	[1]	–
	Nitrate	1	0%	25	25	–	–	–		25
	Nitrite	NA	NA	NA	NA	–	–	–	[1]	–
	Selenium	1	0%	3	3	–	–	–		3
	Silver	NA	NA	NA	NA	–	–	–	[1]	–
	Thallium	NA	NA	NA	NA	–	–	–	[1]	–
	Vanadium	NA	NA	NA	NA	–	–	–	[1]	–
	Zinc	3	0%	25	25	–	–	–		25
GE-MW-19	Aluminum	3	33%	7	11	–	–	–		11
	Antimony	NA	NA	NA	NA	–	–	–	[1]	–
	Arsenic	1	0%	3	3	–	–	–		3
	Beryllium	NA	NA	NA	NA	–	–	–	[1]	–
	Cadmium	3	0%	1	1	–	–	–		1
	Chromium	NA	NA	NA	NA	–	–	–	[1]	–
	Cobalt	NA	NA	NA	NA	–	–	–	[1]	–
	Copper	3	33%	5	11	–	–	–		11
	Iron	3	0%	25	25	–	–	–		25
	Lead	3	0%	1	1	–	–	–	[2]	1
	Manganese	1	100%	90	90	–	–	–		90
	Mercury	NA	NA	NA	NA	–	–	–	[1]	–
	Nickel	NA	NA	NA	NA	–	–	–	[1]	–
	Nitrate	1	0%	25	25	–	–	–		25
	Nitrite	NA	NA	NA	NA	–	–	–	[1]	–
	Selenium	1	100%	5	5	–	–	–		5
	Silver	NA	NA	NA	NA	–	–	–	[1]	–
	Thallium	NA	NA	NA	NA	–	–	–	[1]	–
	Vanadium	NA	NA	NA	NA	–	–	–	[1]	–
	Zinc	3	33%	53	110	–	–	–		110

Table D-10. Off-Site Groundwater Exposure Point Concentrations (Dissolved Fraction)

EXPOSURE UNIT	CHEMICAL	NUMBER OF SAMPLES	DETECTION FREQUENCY	CONCENTRATION (ug/L) MEAN	MAX	95th UCL	DATA DISTRIBUTION	95th UCL METHOD		EXPOSURE POINT CONCENTRATION (ug/L)
GW-6	Aluminum	13	62%	92	334	139	gamma	Approximate Gamma UCL		139
	Antimony	9	0%	8	30	--	--	--		30
	Arsenic	9	11%	4	8	--	--	--		8
	Beryllium	9	22%	0	1	--	--	--		1
	Cadmium	13	77%	9	44	19	gamma	Approximate Gamma UCL		19
	Chromium	9	33%	2	5	--	--	--		5
	Cobalt	9	89%	32	62	--	--	--		62
	Copper	13	23%	6	27	12	lognormal	95% Chebyshev (MVUE) UCL		12
	Iron	13	92%	4,724	32,200	27,788	non-parameteric	99% Chebyshev (Mean, Sd) UCL		27,788
	Lead	13	8%	4	33	NA	NA	NA	[2]	4
	Manganese	9	100%	3,874	11,700	--	--	--		11,700
	Mercury	9	0%	0	0	--	--	--		0
	Nickel	9	100%	14	29	--	--	--		29
	Nitrate	NA	NA	NA	NA	--	--	--	[1]	--
	Nitrite	NA	NA	NA	NA	--	--	--	[1]	--
	Selenium	10	0%	4	18	10	non-parameteric	95% Chebyshev (Mean, Sd) UCL		10
	Silver	9	0%	1	5	--	--	--		5
	Thallium	9	11%	4	13	--	--	--		13
	Vanadium	9	0%	3	25	--	--	--		25
	Zinc	13	100%	397	2,000	727	lognormal	95% H-UCL		727
GW-7	Aluminum	14	100%	19,875	44,900	25,932	normal	Student's t-UCL		25,932
	Antimony	9	0%	8	30	--	--	--		30
	Arsenic	9	44%	5	8	--	--	--		8
	Beryllium	9	89%	4	6	--	--	--		6
	Cadmium	14	100%	38	83	50	normal	Student's t-UCL		50
	Chromium	9	44%	2	5	--	--	--		5
	Cobalt	9	100%	101	175	--	--	--		175
	Copper	14	100%	2,864	6,540	4,158	gamma	Approximate Gamma UCL		4,158
	Iron	14	100%	204	481	311	gamma	Approximate Gamma UCL		311
	Lead	14	50%	3	8	NA	NA	NA	[2]	3
	Manganese	9	100%	2,365	4,100	--	--	--		4,100
	Mercury	9	0%	0	0	--	--	--		0
	Nickel	9	100%	88	149	--	--	--		149
	Nitrate	NA	NA	NA	NA	--	--	--	[1]	--
	Nitrite	NA	NA	NA	NA	--	--	--	[1]	--
	Selenium	10	10%	4	18	11	non-parameteric	95% Chebyshev (Mean, Sd) UCL		11
	Silver	9	0%	2	5	--	--	--		5
	Thallium	9	0%	5	13	--	--	--		13
	Vanadium	9	0%	6	25	--	--	--		25
	Zinc	14	100%	1,151	2,240	1,461	normal	Student's t-UCL		1,461

Table D-10. Off-Site Groundwater Exposure Point Concentrations (Dissolved Fraction)

EXPOSURE UNIT	CHEMICAL	NUMBER OF SAMPLES	DETECTION FREQUENCY	CONCENTRATION (ug/L)			DATA DISTRIBUTION	95th UCL METHOD		EXPOSURE POINT CONCENTRATION (ug/L)
				MEAN	MAX	95th UCL				
GW-8A	Aluminum	10	70%	163	844	347	gamma	Approximate Gamma UCL		347
	Antimony	7	0%	6	30	--	--	--		30
	Arsenic	7	29%	4	10	--	--	--		10
	Beryllium	7	0%	1	3	--	--	--		3
	Cadmium	10	0%	1	3	1	gamma	Approximate Gamma UCL		1
	Chromium	7	0%	1	5	--	--	--		5
	Cobalt	7	14%	4	25	--	--	--		25
	Copper	10	70%	10	28	15	normal	Student's t-UCL		15
	Iron	10	80%	332	1,530	730	gamma	Approximate Gamma UCL		730
	Lead	10	10%	2	5	NA	NA	NA	[2]	2
	Manganese	7	86%	120	460	--	--	--		460
	Mercury	7	0%	0	0	--	--	--		0
	Nickel	7	57%	7	20	--	--	--		20
	Nitrate	NA	NA	NA	NA	--	--	--	[1]	--
	Nitrite	NA	NA	NA	NA	--	--	--	[1]	--
	Selenium	8	0%	2	3	--	--	--		3
	Silver	7	14%	1	5	--	--	--		5
	Thallium	7	0%	4	13	--	--	--		13
	Vanadium	7	0%	4	25	--	--	--		25
	Zinc	10	90%	83	169	109	normal	Student's t-UCL		109
GW-9A	Aluminum	13	31%	34	104	59	gamma	Approximate Gamma UCL		59
	Antimony	9	0%	8	30	--	--	--		30
	Arsenic	9	33%	5	13	--	--	--		13
	Beryllium	9	0%	1	3	--	--	--		3
	Cadmium	13	0%	1	3	1	lognormal	95% H-UCL		1
	Chromium	9	11%	2	5	--	--	--		5
	Cobalt	9	0%	6	25	--	--	--		25
	Copper	13	8%	3	13	5	lognormal	95% H-UCL		5
	Iron	13	38%	35	106	50	gamma	Approximate Gamma UCL		50
	Lead	13	0%	1	5	NA	NA	NA	[2]	1
	Manganese	9	100%	26	43	--	--	--		43
	Mercury	9	11%	0	0	--	--	--		0
	Nickel	9	44%	4	20	--	--	--		20
	Nitrate	NA	NA	NA	NA	--	--	--	[1]	--
	Nitrite	NA	NA	NA	NA	--	--	--	[1]	--
	Selenium	10	0%	4	18	10	non-parameteric	95% Chebyshev (Mean, Sd) UCL		10
	Silver	9	0%	1	5	--	--	--		5
	Thallium	9	0%	5	13	--	--	--		13
	Vanadium	9	0%	6	25	--	--	--		25
	Zinc	13	85%	51	102	64	normal	Student's t-UCL		64

Table D-10. Off-Site Groundwater Exposure Point Concentrations
(Dissolved Fraction)

EXPOSURE UNIT	CHEMICAL	NUMBER OF SAMPLES	DETECTION FREQUENCY	CONCENTRATION (ug/L)			DATA DISTRIBUTION	95th UCL METHOD		EXPOSURE POINT CONCENTRATION (ug/L)
				MEAN	MAX	95th UCL				
GWCDM09	Aluminum	9	100%	26,111	29,300	–	–	–		29,300
	Antimony	5	20%	9	30	–	–	–		30
	Arsenic	5	60%	5	9	–	–	–		9
	Beryllium	5	100%	4	6	–	–	–		6
	Cadmium	9	100%	51	58	–	–	–		58
	Chromium	5	20%	2	5	–	–	–		5
	Cobalt	5	100%	118	139	–	–	–		139
	Copper	9	100%	232	273	–	–	–		273
	Iron	9	100%	27,400	30,900	–	–	–		30,900
	Lead	9	11%	2	6	–	–	–	[2]	2
	Manganese	5	100%	5,138	5,860	–	–	–		5,860
	Mercury	5	0%	0	0	–	–	–		0
	Nickel	5	100%	137	160	–	–	–		160
	Nitrate	NA	NA	NA	NA	–	–	–	[1]	--
	Nitrite	NA	NA	NA	NA	–	–	–	[1]	--
	Selenium	6	0%	7	18	–	–	–		18
	Silver	5	0%	2	5	–	–	–		5
	Thallium	5	40%	4	9	–	–	–		9
	Vanadium	5	0%	10	25	–	–	–		25
	Zinc	9	100%	3,309	3,860	–	–	–		3,860
GWCDM10	Aluminum	9	100%	6,007	7,270	–	–	–		7,270
	Antimony	5	20%	9	30	–	–	–		30
	Arsenic	5	40%	5	8	–	–	–		8
	Beryllium	5	100%	4	5	–	–	–		5
	Cadmium	9	100%	24	29	–	–	–		29
	Chromium	5	20%	2	5	–	–	–		5
	Cobalt	5	100%	103	121	–	–	–		121
	Copper	9	89%	39	50	–	–	–		50
	Iron	9	100%	44,178	52,700	–	–	–		52,700
	Lead	9	11%	2	6	–	–	–	[2]	2
	Manganese	5	100%	4,854	5,400	–	–	–		5,400
	Mercury	5	0%	0	0	–	–	–		0
	Nickel	5	100%	115	131	–	–	–		131
	Nitrate	NA	NA	NA	NA	–	–	–	[1]	--
	Nitrite	NA	NA	NA	NA	–	–	–	[1]	--
	Selenium	6	0%	7	18	–	–	–		18
	Silver	5	0%	3	5	–	–	–		5
	Thallium	5	40%	5	10	–	–	–		10
	Vanadium	5	20%	1	2	–	–	–		2
	Zinc	9	100%	2,749	3,200	–	–	–		3,200

Table D-10. Off-Site Groundwater Exposure Point Concentrations (Dissolved Fraction)

EXPOSURE UNIT	CHEMICAL	NUMBER OF SAMPLES	DETECTION FREQUENCY	CONCENTRATION (ug/L)			DATA DISTRIBUTION	95th UCL METHOD		EXPOSURE POINT CONCENTRATION (ug/L)
				MEAN	MAX	95th UCL				
GWCDM14	Aluminum	9	56%	69	125	–	–	–		125
	Antimony	5	20%	12	30	–	–	–		30
	Arsenic	5	60%	14	25	–	–	–		25
	Beryllium	5	80%	7	15	–	–	–		15
	Cadmium	9	100%	47	79	–	–	–		79
	Chromium	5	40%	2	5	–	–	–		5
	Cobalt	5	100%	316	389	–	–	–		389
	Copper	9	22%	4	13	–	–	–		13
	Iron	9	100%	157,556	215,001	–	–	–		215,001
	Lead	9	44%	5	24	–	–	–	[2]	5
	Manganese	5	100%	9,192	10,700	–	–	–		10,700
	Mercury	5	0%	0	0	–	–	–		0.1
	Nickel	5	100%	270	337	–	–	–		337
	Nitrate	1	0%	25	25	–	–	–		25
	Nitrite	NA	NA	NA	NA	–	–	–	[1]	--
	Selenium	6	0%	7	18	–	–	–		18
	Silver	5	60%	3	7	–	–	–		7
	Thallium	5	60%	13	24	–	–	–		24
	Vanadium	5	20%	3	10	–	–	–		10
	Zinc	9	100%	3,479	4,570	–	–	–		4,570

NA = Not Applicable.
– Due to sample size (less than 10), a 95th UCL was not calculated.

[1] Chemical not analyzed; no EPC for this chemical.
[2] Risks to lead are evaluated based on the mean concentration; a 95th UCL was not calculated.

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Table D-11. Off-Site Groundwater Exposure Point Concentrations (Total Fraction)

EXPOSURE UNIT	CHEMICAL	NUMBER OF SAMPLES	DETECTION FREQUENCY	CONCENTRATION (ug/L)			DATA DISTRIBUTION	95th UCL METHOD		EXPOSURE POINT CONCENTRATION (ug/L)
				MEAN	MAX	95th UCL				
BED11	Aluminum	8	13%	42	107	–	–	–		107
	Antimony	8	0%	5	30	–	–	–		30
	Arsenic	8	0%	3	8	–	–	–		8
	Beryllium	8	0%	0	3	–	–	–		3
	Cadmium	8	13%	0	1	–	–	–		1
	Chromium	8	38%	1	5	–	–	–		5
	Cobalt	NA	NA	NA	NA	–	–	–	[1]	–
	Copper	8	38%	13	33	–	–	–		33
	Iron	9	89%	140	290	–	–	–		290
	Lead	8	38%	5	23	–	–	–	[2]	5
	Manganese	8	88%	1,052	2,390	–	–	–		2,390
	Mercury	8	0%	0	0	–	–	–		0
	Nickel	8	63%	3	7	–	–	–		7
	Nitrate	1	0%	25	25	–	–	–		25
	Nitrite	1	0%	25	25	–	–	–		25
	Selenium	8	0%	4	18	–	–	–		18
	Silver	8	0%	1	5	–	–	–		5
	Thallium	8	0%	4	13	–	–	–		13
	Vanadium	8	13%	4	25	–	–	–		25
	Zinc	8	88%	73	377	–	–	–		377
BED-14	Aluminum	6	83%	472	838	–	–	–		838
	Antimony	2	0%	16	30	–	–	–		30
	Arsenic	2	0%	4.8	7.5	–	–	–		7.5
	Beryllium	2	0%	1.4	2.5	–	–	–		2.5
	Cadmium	6	0%	0.8	2.5	–	–	–		2.5
	Chromium	2	50%	4	5	–	–	–		5
	Cobalt	2	0%	13	25	–	–	–		25
	Copper	6	33%	2	3	–	–	–		3
	Iron	6	100%	1,542	2,770	–	–	–		2,770
	Lead	6	67%	3	7	–	–	–	[2]	3
	Manganese	2	100%	407	469	–	–	–		469
	Mercury	2	0%	0	0	–	–	–		0
	Nickel	2	50%	3	4	–	–	–		4
	Nitrate	1	0%	25	25	–	–	–		25
	Nitrite	NA	NA	NA	NA	–	–	–	[1]	–
	Selenium	3	0%	7	18	–	–	–		18
	Silver	2	0%	3	5	–	–	–		5
	Thallium	2	0%	7	13	–	–	–		13
	Vanadium	2	0%	13	25	–	–	–		25
	Zinc	6	33%	23	29	–	–	–		29

Table D-11. Off-Site Groundwater Exposure Point Concentrations
(Total Fraction)

EXPOSURE UNIT	CHEMICAL	NUMBER OF SAMPLES	DETECTION FREQUENCY	CONCENTRATION (ug/L)			DATA DISTRIBUTION	95th UCL METHOD		EXPOSURE POINT CONCENTRATION (ug/L)
				MEAN	MAX	95th UCL				
BED-19	Aluminum	4	100%	756	1,830	–	–	–		1,830
	Antimony	NA	NA	NA	NA	–	–	–	[1]	--
	Arsenic	NA	NA	NA	NA	–	–	–	[1]	--
	Beryllium	NA	NA	NA	NA	–	–	–	[1]	--
	Cadmium	4	75%	2	3	–	–	–		3
	Chromium	NA	NA	NA	NA	–	–	–	[1]	--
	Cobalt	NA	NA	NA	NA	–	–	–	[1]	--
	Copper	4	100%	101	135	–	–	–		135
	Iron	4	100%	662	1,560	–	–	–		1,560
	Lead	4	100%	58	73	–	–	–	[2]	58
	Manganese	NA	NA	NA	NA	–	–	–	[1]	--
	Mercury	NA	NA	NA	NA	–	–	–	[1]	--
	Nickel	NA	NA	NA	NA	–	–	–	[1]	--
	Nitrate	1	100%	80	80	–	–	–		80
	Nitrite	NA	NA	NA	NA	–	–	–	[1]	--
	Selenium	1	0%	3	3	–	–	–		3
	Silver	NA	NA	NA	NA	–	–	–	[1]	--
	Thallium	NA	NA	NA	NA	–	–	–	[1]	--
	Vanadium	NA	NA	NA	NA	–	–	–	[1]	--
	Zinc	4	100%	190	412	–	–	–		412
BED-7	Aluminum	6	83%	519	1,050	–	–	–		1,050
	Antimony	2	50%	9	10	–	–	–		10
	Arsenic	2	100%	11.4	11.8	–	–	–		11.8
	Beryllium	2	50%	1.6	2.5	–	–	–		2.5
	Cadmium	6	0%	0.8	2.5	–	–	–		2.5
	Chromium	2	100%	8	12	–	–	–		12
	Cobalt	2	0%	13	25	–	–	–		25
	Copper	6	67%	11	38	–	–	–		38
	Iron	7	100%	510	1,700	–	–	–		1,700
	Lead	6	83%	7	23	–	–	–	[2]	7
	Manganese	2	50%	17	27	–	–	–		27
	Mercury	2	0%	0	0	–	–	–		0
	Nickel	2	100%	9	13	–	–	–		13
	Nitrate	1	100%	129	129	–	–	–		129
	Nitrite	NA	NA	NA	NA	–	–	–	[1]	--
	Selenium	3	33%	3	3	–	–	–		3
	Silver	2	0%	3	5	–	–	–		5
	Thallium	2	0%	7	13	–	–	–		13
	Vanadium	2	100%	36	44	–	–	–		44
	Zinc	6	33%	27	33	–	–	–		33

Table D-11. Off-Site Groundwater Exposure Point Concentrations
(Total Fraction)

EXPOSURE UNIT	CHEMICAL	NUMBER OF SAMPLES	DETECTION FREQUENCY	CONCENTRATION (ug/L)			DATA DISTRIBUTION	95th UCL METHOD		EXPOSURE POINT CONCENTRATION (ug/L)
				MEAN	MAX	95th UCL				
	Aluminum	12	42%	118	574	570	lognormal	99% Chebyshev (MVUE) UCL		570
	Antimony	8	0%	5	30	--	--	--		30
	Arsenic	8	25%	19	97	--	--	--		97
	Beryllium	8	13%	0	3	--	--	--		3
	Cadmium	12	50%	1	3	2	gamma	Approximate Gamma UCL		2
	Chromium	8	38%	2	5	--	--	--		5
	Cobalt	8	63%	10	25	--	--	--		25
	Copper	12	75%	23	112	57	lognormal	95% Chebyshev (MVUE) UCL		57
	Iron	13	100%	3,245	26,500	14,505	lognormal	99% Chebyshev (MVUE) UCL		14,505
BES-11	Lead	12	33%	21	129	NA	NA	NA	[2]	21
	Manganese	8	88%	118	581	--	--	--		581
	Mercury	8	50%	0	0	--	--	--		0
	Nickel	8	75%	10	20	--	--	--		20
	Nitrate	2	100%	5,230	6,700	--	--	--		6,700
	Nitrite	1	0%	25	25	--	--	--		25
	Selenium	9	22%	3	7	--	--	--		7
	Silver	8	25%	2	5	--	--	--		5
	Thallium	8	0%	4	13	--	--	--		13
	Vanadium	8	25%	7	25	--	--	--		25
	Zinc	12	100%	375	805	498	normal	Student's t-UCL		498
	Aluminum	6	83%	346	858	--	--	--		858
	Antimony	2	0%	16	30	--	--	--		30
	Arsenic	2	0%	5	8	--	--	--		8
	Beryllium	2	0%	1	3	--	--	--		3
	Cadmium	6	17%	1	3	--	--	--		3
	Chromium	2	50%	4	5	--	--	--		5
	Cobalt	2	0%	13	25	--	--	--		25
	Copper	6	100%	35	59	--	--	--		59
	Iron	6	100%	1,463	3,120	--	--	--		3,120
BES-14	Lead	6	83%	6	14	--	--	--	[2]	6
	Manganese	2	50%	17	27	--	--	--		27
	Mercury	2	0%	0	0	--	--	--		0
	Nickel	2	50%	14	20	--	--	--		20
	Nitrate	1	100%	2,740	2,740	--	--	--		2,740
	Nitrite	NA	NA	NA	NA	--	--	--	[1]	--
	Selenium	3	0%	7	18	--	--	--		18
	Silver	2	0%	3	5	--	--	--		5
	Thallium	2	0%	7	13	--	--	--		13
	Vanadium	2	0%	13	25	--	--	--		25
	Zinc	6	67%	45	76	--	--	--		76

Table D-11. Off-Site Groundwater Exposure Point Concentrations
(Total Fraction)

EXPOSURE UNIT	CHEMICAL	NUMBER OF SAMPLES	DETECTION FREQUENCY	CONCENTRATION (ug/L)			DATA DISTRIBUTION	95th UCL METHOD		EXPOSURE POINT CONCENTRATION (ug/L)
				MEAN	MAX	95th UCL				
BES-17	Aluminum	7	86%	55	138	--	--	--		138
	Antimony	2	0%	16	30	--	--	--		30
	Arsenic	2	100%	169	279	--	--	--		279
	Beryllium	2	50%	2	3	--	--	--		3
	Cadmium	7	0%	1	3	--	--	--		3
	Chromium	2	0%	3	5	--	--	--		5
	Cobalt	2	100%	14	17	--	--	--		17
	Copper	7	29%	8	33	--	--	--		33
	Iron	7	100%	5,983	10,500	--	--	--		10,500
	Lead	7	43%	2	5	--	--	--	[2]	2
	Manganese	2	100%	550	640	--	--	--		640
	Mercury	2	0%	0	0	--	--	--		0
	Nickel	2	100%	9	10	--	--	--		10
	Nitrate	2	0%	25	25	--	--	--		25
	Nitrite	NA	NA	NA	NA	--	--	--	[1]	--
	Selenium	3	0%	2	3	--	--	--		3
	Silver	2	0%	3	5	--	--	--		5
	Thallium	2	0%	7	13	--	--	--		13
	Vanadium	2	0%	13	25	--	--	--		25
	Zinc	7	57%	43	66	--	--	--		66
CDM06b	Aluminum	1	100%	894	894	--	--	--		894
	Antimony	NA	NA	NA	NA	--	--	--	[1]	--
	Arsenic	NA	NA	NA	NA	--	--	--	[1]	--
	Beryllium	NA	NA	NA	NA	--	--	--	[1]	--
	Cadmium	1	100%	10	10	--	--	--		10
	Chromium	NA	NA	NA	NA	--	--	--	[1]	--
	Cobalt	NA	NA	NA	NA	--	--	--	[1]	--
	Copper	1	100%	48	48	--	--	--		48
	Iron	1	100%	495	495	--	--	--		495
	Lead	1	100%	1	1	--	--	--	[2]	1
	Manganese	NA	NA	NA	NA	--	--	--	[1]	--
	Mercury	NA	NA	NA	NA	--	--	--	[1]	--
	Nickel	NA	NA	NA	NA	--	--	--	[1]	--
	Nitrate	NA	NA	NA	NA	--	--	--	[1]	--
	Nitrite	NA	NA	NA	NA	--	--	--	[1]	--
	Selenium	1	0%	3	3	--	--	--		3
	Silver	NA	NA	NA	NA	--	--	--	[1]	--
	Thallium	NA	NA	NA	NA	--	--	--	[1]	--
	Vanadium	NA	NA	NA	NA	--	--	--	[1]	--
	Zinc	1	100%	337	337	--	--	--		337

Table D-11. Off-Site Groundwater Exposure Point Concentrations
(Total Fraction)

EXPOSURE UNIT	CHEMICAL	NUMBER OF SAMPLES	DETECTION FREQUENCY	CONCENTRATION (ug/L) MEAN	MAX	95th UCL	DATA DISTRIBUTION	95th UCL METHOD		EXPOSURE POINT CONCENTRATION (ug/L)
GE-MW-18	Aluminum	3	100%	15,277	39,900	–	–	–		39,900
	Antimony	NA	NA	NA	NA	–	–	–	[1]	–
	Arsenic	1	100%	7	7	–	–	–		7
	Beryllium	NA	NA	NA	NA	–	–	–	[1]	–
	Cadmium	3	33%	4	11	–	–	–		11
	Chromium	NA	NA	NA	NA	–	–	–	[1]	–
	Cobalt	NA	NA	NA	NA	–	–	–	[1]	–
	Copper	3	67%	26	69	–	–	–		69
	Iron	3	100%	14,453	37,100	–	–	–		37,100
	Lead	3	100%	31	80	–	–	–	[2]	31
	Manganese	1	100%	753	753	–	–	–		753
	Mercury	NA	NA	NA	NA	–	–	–	[1]	–
	Nickel	NA	NA	NA	NA	–	–	–	[1]	–
	Nitrate	3	33%	47	91	–	–	–		91
	Nitrite	1	0%	25	25	–	–	–		25
	Selenium	1	0%	3	3	–	–	–		3
	Silver	NA	NA	NA	NA	–	–	–	[1]	–
	Thallium	NA	NA	NA	NA	–	–	–	[1]	–
	Vanadium	NA	NA	NA	NA	–	–	–	[1]	–
	Zinc	3	67%	78	158	–	–	–		158
GE-MW-19	Aluminum	3	100%	89	126	–	–	–		126
	Antimony	NA	NA	NA	NA	–	–	–	[1]	–
	Arsenic	1	0%	3	3	–	–	–		3
	Beryllium	NA	NA	NA	NA	–	–	–	[1]	–
	Cadmium	3	0%	1	1	–	–	–		1
	Chromium	NA	NA	NA	NA	–	–	–	[1]	–
	Cobalt	NA	NA	NA	NA	–	–	–	[1]	–
	Copper	3	67%	7	14	–	–	–		14
	Iron	3	100%	157	223	–	–	–		223
	Lead	3	33%	1	3	–	–	–	[2]	1
	Manganese	1	100%	104	104	–	–	–		104
	Mercury	NA	NA	NA	NA	–	–	–	[1]	–
	Nickel	NA	NA	NA	NA	–	–	–	[1]	–
	Nitrate	3	67%	6,335	17,800	–	–	–		17,800
	Nitrite	1	0%	25	25	–	–	–		25
	Selenium	1	100%	5	5	–	–	–		5
	Silver	NA	NA	NA	NA	–	–	–	[1]	–
	Thallium	NA	NA	NA	NA	–	–	–	[1]	–
	Vanadium	NA	NA	NA	NA	–	–	–	[1]	–
	Zinc	3	67%	51	77	–	–	–		77

Table D-11. Off-Site Groundwater Exposure Point Concentrations
(Total Fraction)

EXPOSURE UNIT	CHEMICAL	NUMBER OF SAMPLES	DETECTION FREQUENCY	CONCENTRATION (ug/L)			DATA DISTRIBUTION	95th UCL METHOD		EXPOSURE POINT CONCENTRATION (ug/L)
				MEAN	MAX	95th UCL				
GW-6	Aluminum	13	77%	233	542	294	normal	Student's t-UCL		294
	Antimony	9	11%	6	30	--	--	--		30
	Arsenic	9	44%	6	18	--	--	--		18
	Beryllium	9	22%	1	1	--	--	--		1
	Cadmium	13	92%	18	51	25	normal	Student's t-UCL		25
	Chromium	9	44%	3	8	--	--	--		8
	Cobalt	9	100%	34	77	--	--	--		77
	Copper	13	92%	33	102	59	gamma	Approximate Gamma UCL		59
	Iron	14	100%	4,664	9,800	5,996	normal	Student's t-UCL		5,996
	Lead	13	77%	16	45	NA	NA	NA	[2]	16
	Manganese	9	100%	3,203	7,170	--	--	--		7,170
	Mercury	9	0%	0	0	--	--	--		0
	Nickel	9	100%	15	33	--	--	--		33
	Nitrate	2	0%	25	25	--	--	--		25
	Nitrite	1	0%	25	25	--	--	--		25
	Selenium	10	0%	5	18	14	non-parameteric	95% Chebyshev (Mean, Sd) UCL		14
	Silver	9	11%	2	5	--	--	--		5
	Thallium	9	22%	4	13	--	--	--		13
	Vanadium	9	0%	6	25	--	--	--		25
	Zinc	13	100%	619	2,240	981	gamma	Approximate Gamma UCL		981
GW-7	Aluminum	14	100%	21,029	45,200	26,949	normal	Student's t-UCL		26,949
	Antimony	9	0%	8	30	--	--	--		30
	Arsenic	9	44%	5	8	--	--	--		8
	Beryllium	9	78%	3	6	--	--	--		6
	Cadmium	14	100%	77	300	136	gamma	Approximate Gamma UCL		136
	Chromium	9	56%	3	10	--	--	--		10
	Cobalt	9	100%	101	175	--	--	--		175
	Copper	14	100%	2,835	6,530	4,082	gamma	Approximate Gamma UCL		4,082
	Iron	15	100%	604	1,710	815	normal	Student's t-UCL		815
	Lead	14	79%	5	18	NA	NA	NA	[2]	5
	Manganese	9	100%	2,342	4,110	--	--	--		4,110
	Mercury	9	11%	0	0	--	--	--		0
	Nickel	9	100%	88	149	--	--	--		149
	Nitrate	3	100%	4,737	5,250	--	--	--		5,250
	Nitrite	1	0%	25	25	--	--	--		25
	Selenium	10	0%	4	18	10	non-parameteric	95% Chebyshev (Mean, Sd) UCL		10
	Silver	9	0%	1	5	--	--	--		5
	Thallium	9	0%	5	13	--	--	--		13
	Vanadium	9	0%	6	25	--	--	--		25
	Zinc	14	100%	1,131	2,240	1,438	normal	Student's t-UCL		1,438

Table D-11. Off-Site Groundwater Exposure Point Concentrations
(Total Fraction)

EXPOSURE UNIT	CHEMICAL	NUMBER OF SAMPLES	DETECTION FREQUENCY	CONCENTRATION (ug/L)			DATA DISTRIBUTION	95th UCL METHOD		EXPOSURE POINT CONCENTRATION (ug/L)
				MEAN	MAX	95th UCL				
GW-8A	Aluminum	11	100%	6,260	25,200	13,857	gamma	Approximate Gamma UCL		13,857
	Antimony	8	0%	8	30	–	–	–		30
	Arsenic	8	38%	5	13	–	–	–		13
	Beryllium	8	38%	1	5	–	–	–		5
	Cadmium	11	36%	2	6	4	gamma	Approximate Gamma UCL		4
	Chromium	8	88%	31	96	–	–	–		96
	Cobalt	8	38%	5	25	–	–	–		25
	Copper	11	100%	305	2,310	792	gamma	Approximate Gamma UCL		792
	Iron	11	100%	18,059	113,000	43,150	gamma	Approximate Gamma UCL		43,150
	Lead	11	82%	41	293	NA	NA	NA	[2]	41
	Manganese	8	100%	358	1,070	–	–	–		1,070
	Mercury	8	13%	0	0	–	–	–		0
	Nickel	8	100%	26	84	–	–	–		84
	Nitrate	2	100%	569	697	–	–	–		697
	Nitrite	1	100%	56	56	–	–	–		56
	Selenium	9	0%	2	3	–	–	–		3
	Silver	8	25%	1	5	–	–	–		5
	Thallium	8	0%	4	13	–	–	–		13
	Vanadium	8	50%	10	30	–	–	–		30
	Zinc	11	91%	129	401	205	gamma	Approximate Gamma UCL		205
GW-9A	Aluminum	13	69%	219	792	462	gamma	Approximate Gamma UCL		462
	Antimony	9	0%	8	30	–	–	–		30
	Arsenic	9	33%	5	12	–	–	–		12
	Beryllium	9	22%	0	3	–	–	–		3
	Cadmium	13	0%	1	3	1	lognormal	95% H-UCL		1
	Chromium	9	44%	3	12	–	–	–		12
	Cobalt	9	0%	6	25	–	–	–		25
	Copper	13	77%	13	82	27	gamma	Approximate Gamma UCL		27
	Iron	14	86%	720	2,890	1,299	gamma	Approximate Gamma UCL		1,299
	Lead	13	62%	3	13	NA	NA	NA	[2]	3
	Manganese	9	100%	55	111	–	–	–		111
	Mercury	9	0%	0	0	–	–	–		0
	Nickel	9	56%	6	20	–	–	–		20
	Nitrate	2	0%	25	25	–	–	–		25
	Nitrite	1	0%	25	25	–	–	–		25
	Selenium	10	0%	5	18	14	non-parameteric	95% Chebyshev (Mean, Sd) UCL		14
	Silver	9	0%	1	5	–	–	–		5
	Thallium	9	0%	5	13	–	–	–		13
	Vanadium	9	22%	4	25	–	–	–		25
	Zinc	13	54%	17	35	23	normal	Student's t-UCL		23

Table D-11. Off-Site Groundwater Exposure Point Concentrations
(Total Fraction)

EXPOSURE UNIT	CHEMICAL	NUMBER OF SAMPLES	DETECTION FREQUENCY	CONCENTRATION (ug/L) MEAN	MAX	95th UCL	DATA DISTRIBUTION	95th UCL METHOD		EXPOSURE POINT CONCENTRATION (ug/L)
GWCDM09	Aluminum	9	100%	27,344	30,100	–	–	–		30,100
	Antimony	5	0%	13	30	–	–	–		30
	Arsenic	5	60%	7	12	–	–	–		12
	Beryllium	5	80%	4	6	–	–	–		6
	Cadmium	9	100%	52	58	–	–	–		58
	Chromium	5	40%	3	6	–	–	–		6
	Cobalt	5	100%	117	132	–	–	–		132
	Copper	9	100%	261	387	–	–	–		387
	Iron	9	100%	29,178	32,000	–	–	–		32,000
	Lead	9	33%	3	7	–	–	–	[2]	3
	Manganese	5	100%	5,170	5,800	–	–	–		5,800
	Mercury	5	20%	0	0	–	–	–		0
	Nickel	5	100%	139	157	–	–	–		157
	Nitrate	1	0%	25	25	–	–	–		25
	Nitrite	NA	NA	NA	NA	–	–	–	[1]	–
	Selenium	6	0%	7	18	–	–	–		18
	Silver	5	20%	1	5	–	–	–		5
	Thallium	5	40%	6	13	–	–	–		13
	Vanadium	5	60%	6	25	–	–	–		25
	Zinc	9	100%	3,368	3,680	–	–	–		3,680
GWCDM10	Aluminum	9	100%	6,433	7,550	–	–	–		7,550
	Antimony	5	20%	9	30	–	–	–		30
	Arsenic	5	20%	5	8	–	–	–		8
	Beryllium	5	80%	4	6	–	–	–		6
	Cadmium	9	100%	25	29	–	–	–		29
	Chromium	5	20%	2	5	–	–	–		5
	Cobalt	5	100%	105	122	–	–	–		122
	Copper	9	100%	42	49	–	–	–		49
	Iron	9	100%	45,822	52,500	–	–	–		52,500
	Lead	9	22%	2	6	–	–	–	[2]	2
	Manganese	5	100%	4,932	5,400	–	–	–		5,400
	Mercury	5	0%	0	0	–	–	–		0.1
	Nickel	5	100%	116	130	–	–	–		130
	Nitrate	1	0%	25	25	–	–	–		25
	Nitrite	NA	NA	NA	NA	–	–	–	[1]	–
	Selenium	6	0%	7	18	–	–	–		18
	Silver	5	20%	3	5	–	–	–		5
	Thallium	5	20%	6	13	–	–	–		13
	Vanadium	5	40%	1	3	–	–	–		3
	Zinc	9	100%	2,852	3,260	–	–	–		3,260

Table D-11. Off-Site Groundwater Exposure Point Concentrations
(Total Fraction)

EXPOSURE UNIT	CHEMICAL	NUMBER OF SAMPLES	DETECTION FREQUENCY	CONCENTRATION (ug/L)			DATA DISTRIBUTION	95th UCL METHOD		EXPOSURE POINT CONCENTRATION (ug/L)
				MEAN	MAX	95th UCL				
GWCDM14	Aluminum	9	89%	651	2,930	–	–	–		2,930
	Antimony	5	20%	13	32	–	–	–		32
	Arsenic	5	80%	30	47	–	–	–		47
	Beryllium	5	100%	8	13	–	–	–		13
	Cadmium	9	100%	49	84	–	–	–		84
	Chromium	5	40%	7	15	–	–	–		15
	Cobalt	5	100%	300	398	–	–	–		398
	Copper	9	22%	5	17	–	–	–		17
	Iron	9	100%	164,333	252,999	–	–	–		252,999
	Lead	9	44%	7	33	–	–	–	[2]	7
	Manganese	5	100%	9,068	12,600	–	–	–		12,600
	Mercury	5	20%	0	0	–	–	–		0
	Nickel	5	100%	257	335	–	–	–		335
	Nitrate	1	0%	25	25	–	–	–		25
	Nitrite	NA	NA	NA	NA	–	–	–	[1]	–
	Selenium	6	0%	7	18	–	–	–		18
	Silver	5	40%	4	7	–	–	–		7
	Thallium	5	20%	9	29	–	–	–		29
	Vanadium	5	60%	5	15	–	–	–		15
	Zinc	9	100%	3,431	4,530	–	–	–		4,530

NA = Not Applicable.
– Due to sample size (less than 10), a 95th UCL was not calculated.

[1] Chemical not analyzed; no EPC for this chemical.
[2] Risks to lead are evaluated based on the mean concentration; a 95th UCL was not calculated.

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PROUCL OUTPUT FILES

(ELECTRONIC FILES AVAILABLE UPON REQUEST)

APPENDIX E

PEF DERIVATION

1.0 INTRODUCTION

One pathway that humans may be exposed to contaminants in soil is by inhalation of particles of soil that become re-suspended in air. When reliable site-specific measurements of contaminant levels in air due to re-suspended soil particles are not available, the concentration of contaminants may be estimated as follows (USEPA 1996, 2002):

$$C_{air} = C_{soil} \bullet PEF$$

where:

C_{air}	=	Concentration of contaminant in air (mg/m^3)
C_{soil}	=	Concentration of contaminant in soil (mg/kg)
PEF	=	Soil to air emission factor (kg/m^3)

Note the PEF term in this equation is the inverse of the value presented in USEPA (1996, 2002), which has units of m^3/kg.

The value of PEF depends on a number of site-specific factors, as well as the nature of the force (wind, mechanical disturbance) that leads to soil particle re-suspension in air. The following sections present the derivation of the PEF values used to estimate contaminant concentrations in air from the re-suspension of soil attributable to wind erosion (PEF_{we}), dirt-bike riding (PEF_{dbr}). ATV riding (PEF_{atv}), and construction activities (PEF_{constr}).

2.0 DERIVATION OF THE PEF FOR WIND EROSION (PEF_{we})

The basic equation used to calculate the PEF for particulates suspended in air from wind erosion is (USEPA 1996, 2002):

$$PEF_{we} = \frac{0.036 \cdot (1-V) \cdot (U_m/U_t)^3 \cdot F(x)}{3600\,\mathrm{sec}/hr \cdot (Q/C)}$$

where:

PEF_{we}	=	Particulate Emission Factor for wind erosion (kg/m^3)
V	=	Fraction of vegetative cover (unitless)
U_m	=	Mean annual windspeed (m/s)
U_t	=	Equivalent threshold value of windspeed at 7 m (m/s)
$F(x)$	=	Function dependent on U_m/U_t derived using Cowherd et al. (1985) (unitless)
x	=	$0.886 \bullet (U_m/U_t)$
Q/C	=	Inverse of soil particle concentration in air (kg/m^3) per unit release rate (kg/m^2-sec) in the center of a square source area (g/m^2-s per kg/m^3)

The value of *Q/C* is given by the following (USEPA 2002):

$$Q/C_{wind} = A \bullet exp\,[(ln\,A_{source} - B)^2/C]$$

where:

A,B,C	=	Constants based on air dispersion modeling for specific climate zones (unitless)
A_{source}	=	Size of the site or source of contamination (acres)

The default or site-specific values and assumptions for evaluating emissions from soil due to wind erosion are summarized in Table 1. Based on these parameters, the PEF for release of soil particles into air due to wind erosion at this site is 5.93E-9 kg/m^3.

3.0 ESTIMATION OF THE PEF FOR ALL TERRAIN VEHICLE RIDING (PEF_{atv})

A PEF value for riding All Terrain Vehicles (ATVs) was derived from empirical data. USEPA (Brass, 2006) collected measurements of total dust in air during use of 2 ATVs at the Quincy Smelter site California during August 2004. A Thermo Electron DataRam 4 (http://www.thermo.com/com/cda/product/detail/1,1055,22453,00.html#Accessories Expand Versatility) was attached to the front rack of the tailing ATV and measurements of total dust, temperature and humidity were collected over a 6 hour period. The total dust measurements are presented electronically in Attachment 1. Summary statistics are presented in Table 3. Concentrations of dust in air varied considerably during the 6 hour period, from a minimum concentration of 18.7 ug/m^3 to a maximum concentration of 23,359 ug/m^3. Several factors are likely to influence the wide range of observed concentrations, including: variation in speed, position of the ATVs relative to one another (directly behind, perpendicular, etc.) and distance between the vehicles.

From these data a PEF for ATV riding was estimated by taking the mean concentration of dust in air generated during ATV use and multiplying by the fraction of total dust that is respirable to estimate the PM10 generated during dirt bike riding. This calculation is as follows:

$$PEF_{atv} = f_{PM10} \bullet C_{Total\ Dust} * CF$$

where:

PEF_{atv}	=	Particulate emission factor for ATV riding (kg/m^3)
f_{PM10}	=	Fraction of total dust that is PM_{10} (unitless)
$C_{Total\ Dust}$	=	Concentration of total dust (ug/m^3)
CF	=	Conversion Factor (kg/ug)

The assumptions for evaluating emissions from dirt bike riding are summarized in Table 2. Based on these parameters, the PEF for release of soil particles into air due to ATV riding is 1.18E-06 kg/m^3.

4.0 DERIVATION OF THE PEF FOR CONSTRUCTION ACTIVITIES (PEF_{const})

The basic equation used to calculate the PEF for particulates suspended in air from construction activities (excavation, dozing, grading, tilling and wind erosion) is (USEPA 2002, Equation E-26):

$$PEF_{constr} = \frac{F_d \cdot J_t}{Q/C_{sc}}$$

where:

Q/C_{sc}	=	Subchronic particulate emission factor for construction activities other than traffic on unpaved roads (kg/m^3)
F_d	=	Dispersion correction factor (unitless) (Equation E-16)
J'_t	=	Total time-averaged PM10 unit emission flux for construction activities other than traffic on unpaved roads (g/m^2-s) (Equation E-25)

and:

$$J't = \frac{M_{wind} + M_{excav} + M_{doz} + M_{grade} + M_{till}}{A_c * T}$$

where:

M_{wind}	=	Unit mass emitted from wind erosion (g)
M_{excav}	=	Unit mass emitted from excavation soil dumping (g)
M_{doz}	=	Unit mass emitted from dozing operations (g)
M_{grade}	=	Unit mass emitted from grading operations (g)
M_{till}	=	Unit mass emitted from tilling operations (g)
A_c	=	Area extent of site soil contamination (m2)
T	=	Duration of construction (s)

The default and site-specific values and assumptions used to evaluate emissions of particulates suspended during construction activities are summarized in Table 3.

Based on these parameters, the PEF for release of soil particles into air due to wind erosion at this site is 2.86E-08 kg/m^3.

5.0 PEF SUMMARY

The PEFs derived for use in estimating concentrations of contaminants in air for the exposure scenarios considered in the risk assessment are as follows:

Exposure Scenario	PEF (kg/m^3)
Wind Erosion (PEF_{we})	5.93E-09
All Terrain Vehicle Riding (PEF_{atv})	1.18E-06
Construction Activities ($PEF_{constr.}$)	2.86E-08

6.0 REFERENCES

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United States Environmental Protection Agency (USEPA). 2002. Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. OSWER 9355.4-24. December.

TABLE 1.
PARAMETERS USED TO CALCULATE PEF FOR WIND EROSION

Parameter	Parameter Definition	Value	Units	Source	Notes
Q/C_{wind}	Inverse of mean concentration at center of source	--	(g/m2-s per kg/m3)	USEPA (2002)	Site-specific dispersion factor (Q/Cwind) calculated based on Appendix D (exhibit D-2) using regional climate constants and site-specific source size.
V	Fraction of vegetative cover	0.25	unitless	--	Professional judgment, estimated from aerial photograph of site.
U_m	Mean annual windspeed	5	m/s	Cowherd et al. (1985)	Mean annual windspeed for Rapid City, South Dakota (Cowherd et al., 1985, Table 4-1)
U_t	Equivalent threshold value of windspeed at 7 m	11.32	m/s	USEPA (1991,1996, 2002)	Default (USEPA, 1991 and 1996), based on open terrain.
F(x)	Function dependent on Um/Ut derived using USEPA (1985, Figure 4-3)	0.3	unitless	Cowherd et al. (1985)	Site-specific based on Cowherd (1985, Figure 4-3), using mean annual windspeed for Rapid City, South Dakota.
A	Constants based on air dispersion modeling for specific climate zones	15.0235	unitless	USEPA (2002)	Zone 5, Bismarck, North Dakota
B	Constants based on air dispersion modeling for specific climate zones	18.2526	unitless	USEPA (2002)	Zone 5, Bismarck, North Dakota
C	Constants based on air dispersion modeling for specific climate zones	207.3387	unitless	USEPA (2002)	Zone 5, Bismarck, North Dakota
A_{source}	Area extent of the site or contamination	258	acres	USEPA (2001)	Approximate area of site (USEPA 2001)

TABLE 2.
PARAMETERS USED TO CALCULATE PEF FOR ATV RIDING

Parameter	Parameter Definition	Value	Units	Source	Notes
f_{PM10}	Fraction of total dust that is PM10	0.35	unitless	USEPA 2006	Professional judgment, based on characteristics of sensing technology, field observations, sieve analysis, and aggressive nature of the soil disturbance.
$C_{Total\ Dust}$	Concentration of total dust in air during ATV riding	3.4E+03	ug/m^3	USEPA 2006	Mean total dust concentration in air over a six hour riding period.
CF	Conversion Factor	1E-09	kg/ug	--	--

TABLE 3.
PARAMETERS USED TO CALCULATE PEF FOR CONSTRUCTION ACTIVITIES

Parameter	Parameter Definition	Value	Units	Source	Notes
Q/C_{sc}	Subchronic particulate emission factor for construction activities other than traffic on unpaved roads (kg/m3)	5.264717	m^3/kg	USEPA (2002)	Site-specific dispersion factor (Q/Cwind) calculated based on Appendix D (exhibit D-2) using regional climate constants and site-specific source size.
F_D	Dispersion correction factor	0.183143	unitless	USEPA (2002)	Calculated from USEPA 2002, Equation E-16. Assumes 8 hr/day, 5 days/week, 52 weeks/year for duration of construction.
8.2E-07	Total time-averaged PM10 unit emission flux for construction activities	8.21E-07	g/m2-sec	USEPA (2002)	Calculated from USEPA 2002, Equation E-25. Site-specific assumptions include duration of contruction is is 2080 hours (8 hr/day, 5 days/week, 52 weeks/year); areas of site is 258 acres; fraction of vegetative cover is 0.25.

USEPA (2002) United States Environmental Protection Agency (USEPA). 2002. Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. OSWER 9355.4-24. December.

ATTACHMENT 1.
RAW DATA COLLECTED DURING ATV RIDING AT THE QUINCY SMELTER SITE

(see *DATARAM.xls* file on attached CD)

APPENDIX F

DETAILED RISK CALCULATIONS

(ELECTRONIC FILES AVAILABLE UPON REQUEST)

TARGET SHEET

EPA REGION VIII

SUPERFUND DOCUMENT MANAGEMENT SYSTEM

DOCUMENT NUMBER: 1068608

SITE NAME: GILT EDGE MINE

DOCUMENT DATE: 07/01/2006

DOCUMENT NOT SCANNED

Due to one of the following reasons:

- ☐ PHOTOGRAPHS
- ☐ 3-DIMENSIONAL
- ☐ OVERSIZED
- ☑ AUDIO/VISUAL
- ☐ PERMANENTLY BOUND DOCUMENTS
- ☐ POOR LEGIBILITY
- ☐ OTHER
- ☐ NOT AVAILABLE
- ☐ TYPES OF DOCUMENTS NOT TO BE SCANNED (Data Packages, Data Validation, Sampling Data, CBI, Chain of Custody)

DOCUMENT DESCRIPTION:

1 CD - BASELINE HUMAN HEALTH RISK ASSESSMENT, FINAL, APPENDICES

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